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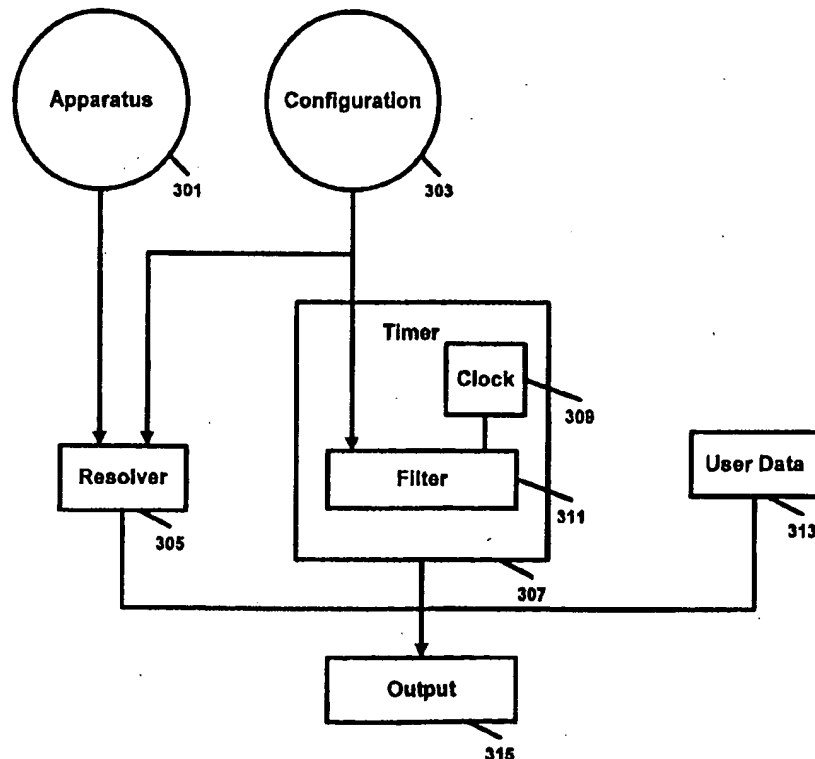
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(54) Title: AUTOMATED SYSTEM FOR IMAGE ARCHIVING

(57) Abstract

A method for producing universal image tracking implementations. This invention provides a functional implementation, from which any image-producing device can construct automatically generated archival enumerations. This implementation uses an encoding schemata based on location numbers, image numbers, and parent numbers, anticipated by the formal specifications. Location numbers encode information about logical sequence in the archive, image numbers encode information about the physical attributes of an image, and parent numbers record the conception date and time of a given image's parent. Parent-child relations are algorithmically derivable from location and parent number relationships, thus providing fully recoverable, cumulative image lineage information. Encoding schemata are optimized for use with all current and arriving barcode symbologies to facilitate data transportation across disparate technologies (e.g., negatives to prints to computers). The implemented system is seamlessly compatible with traditional database "key-driven" recovery systems, as well as with portable decoding systems capable of reading self-contained databases directly from images.



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Title: Automated System for Image Archiving

1 Reference to Related Application

2 This application claims the benefit of U.S. Provisional
3 Application No. 60/035,485 filed January 13, 1997 entitled
4 "Automated Image Archiving System."

5 Field of Invention

6 This invention relates generally to archive and
7 documentation of data. More particularly this invention is a
8 universal image tracking system wherein generations of images
9 can be related one to another and to original images that
10 contributed to a final image without significant user
11 intervention.

12 Background of the Invention

13 Increasingly, images of various types are being used in a
14 wide variety of industrial, digital, medical, and consumer
15 uses. In the medical field, telemedicine has made tremendous
16 advances that now allow a digital image from some medical
17 sensor to be transmitted to specialists who have the requisite
18 expertise to diagnose injury and disease at locations remote
19 from where the patient lies. However, it can be extremely
20 important for a physician, or indeed any other person to
21 understand how the image came to appear as it does. This
22 involves a knowledge of how the image was processed in order
23 to reach the rendition being examined. In certain scientific
24 applications, it may be important to "back out" the effect of

1 a particular type of processing in order to more precisely
2 understand the appearance of the image when first made.

3 Varieties of mechanisms facilitate storage and retrieval
4 of archival information relating to images. However, these
5 archival numbering and documentation schemes suffer from
6 certain limitations. For example, classificatory schemata are
7 used to facilitate machine sorting of information about a
8 subject ("subject information") according to categories into
9 which certain subjects fit. Additionally tracking in-
10 formation, that is, information concerning where the image has
11 been or how the image was processed, is also used together
12 with classificatory schemata.

13 However, relying on categorizing schemata is inefficient
14 and ineffective. On the one hand, category schemata that are
15 limited in size (i.e. number of categories) are convenient to
16 use but insufficiently comprehensive for large-scale
17 applications, such as libraries and national archives.
18 Alternatively if the classificatory schemata is sufficiently
19 comprehensive for large-scale applications, it may well be far
20 too complicated, and therefore inappropriate for small scale
21 applications, such as individual or corporate collections of
22 image data.

23 It is also an approach to provide customizable
24 enumeration strategies to narrow the complexity of large-scale
25 systems and make them discipline specific. Various archiving
26 schemes are developed to suit a particular niche or may be

1 customizable for a niche. This is necessitated by the fact
2 that no single solution universally applies to all disci-
3 plines, as noted above. However, the resulting customized
4 archival implementation will differ from, for example, a
5 medical image to a laboratory or botanical image archive. The
6 resulting customized image archive strategy may be very easy
7 to use for that application but will not easily translate to
8 other application areas.

9 Thus, the utility provided by market niche image
10 archiving software simultaneously makes the resulting
11 applications not useful to a wide spectrum of applications.
12 For example, tracking schemata that describes art history
13 categories might not apply to high-tech advertising.

14 Another type of archival mechanism is equipment-specific
15 archiving. In this implementation a particular type of image
16 device, such as a still camera, a video camera, a digital
17 scanner, or other form of imaging means has its own scheme for
18 imprinting or recording archival information relating to the
19 image that is recorded.

20 Thus, using different image-producing devices in the
21 image production chain can cause major problems. For example,
22 mixing traditional photography (with its archive notation)
23 with digital touch-up processing (with its own different
24 archive notation). Further, equipment-specific archive
25 schemes do not automate well, since multiple devices within
26 the same archive may use incompatible enumeration schemata.

1 Certain classification approaches assume single device
2 input. Thus, multiple devices must be tracked in separate
3 archives, or are tracked as archive exceptions. This makes
4 archiving maintenance more time consuming and inefficient.
5 For example, disciplines that use multiple cameras
6 concurrently, such as sports photography and photo-journalism,
7 confront this limitation.

8 Yet other archive approaches support particular media
9 formats, but not multiple media formats simultaneously
10 occurring in the archive. For example, an archive scheme may
11 support conventional silver halide negatives but not video or
12 digital media within the same archive.

13 Thus, this approach fails when tracking the same image
14 across different media formats, such as tracking negative,
15 transparency, digital, and print representation of the same
16 image.

17 Yet another archive approach may apply to a particular
18 state of the image, as the initial or final format, but does
19 not apply to the full life-cycle of all image. For example,
20 some cameras time- and date-stamp negatives, while database
21 software creates tracking information after processing. While
22 possibly overlapping, the enumeration on the negatives differs
23 from the enumeration created for archiving. In another
24 example, one encoding may track images on negatives and
25 another encoding may track images on prints. However, such a
26 state-specific approach makes it difficult automatically to

1 track image histories and lineages across all phases of an
2 image's life-cycle, such as creation, processing, editing,
3 production, and presentation.

4 Thus, tracking information that uses different encoding
5 for different image states is not particularly effective since
6 maintaining multiple enumeration strategies creates potential
7 archival error, or at a minimum, will not translate well from
8 one image form to another.

9 Some inventions that deal with recording information
10 about images have been the subject of U.S. patents in the
11 past. U.S. Patent No. 5579067 to Wakabayashi describes a
12 "Camera Capable of Recording Information." This system
13 provides a camera which records information into an
14 information recording area provided on the film that is loaded
15 in the camera. If information does not change from frame to
16 frame, no information is recorded. However, this invention
17 does not deal with recording information on subsequent
18 processing.

19 U.S. Patent No. 5455648 to Kazami was granted for a "Film
20 Holder or for Storing Processed Photographic Film." This
21 invention relates to a film holder which also includes an
22 information holding section on the film holder itself. This
23 information recording section holds electrical, magnetic, or
24 optical representations of film information. However, once the
25 information is recorded, it is to used for purposes other than
26 to identify the original image.

1 U.S. Patent No. 5649247 to *Itoh* was issued for an
2 "Apparatus for Recording Information of Camera Capable of
3 Optical Data Recording and Magnetic Data Recording." This
4 patent provides for both optical recording and magnetic
5 recording onto film. This invention is an electrical circuit
6 that is resident in a camera system which records such
7 information as aperture value, shutter time, photo metric
8 value, exposure information, and other related information
9 when an image is first photographed. This patent does not
10 relate to recording of subsequent operations relating to the
11 image.

12 U.S. Patent 5319401 to *Hicks* was granted for a "Control
13 System for Photographic Equipment." This invention deals with
14 a method for controlling automated photographic equipment such
15 as printers, color analyzers, film cutters. This patent
16 allows for a variety of information to be recorded after the
17 images are first made. It mainly teaches methods for
18 production of pictures and for recording of information
19 relating to that production. For example, if a photographer
20 consistently creates a series of photographs which are off
21 center, information can be recorded to offset the negative by
22 a pre-determined amount during printing. Thus the
23 information does not accompany the film being processed but it
24 does relate to the film and is stored in a separate database.
25 The information stored is therefore not helpful for another
26 laboratory that must deal with the image that is created.

1 U.S. Patent 5193185 to Lanter was issued for a "Method
2 and Means for Lineage Tracing of a Spatial Information
3 Processing and Database System." This Patent relates to
4 geographic information systems. It provides for "parent" and
5 "child" links that relate to the production of layers of
6 information in a database system. Thus while the this patent
7 relates to computer-generated data about maps, it does not
8 deal with how best too transmit that information along a chain
9 of image production.

10 U.S. Patent No. 5008700 to Okamoto was granted for a
11 "Color Image Recording Apparatus using Intermediate Image
12 Sheet." This patent describes a system, where a bar code is
13 printed on the image production media which can then be read
14 by an optical reader. This patent does not deal with
15 subsequent processing of images which can take place or
16 recording of information that relates to that subsequent
17 processing.

18 U.S. Patent No. 4728978 was granted to Inoue for a
19 "Photographic Camera." This patent describes a photographic
20 camera which records information about exposure or development
21 on an integrated circuit card which has a semiconductor
22 memory. This card records a great deal of different types of
23 information and records that information onto film. The
24 information which is recorded includes color temperature
25 information, exposure reference information, the date and
26 time, shutter speed, aperture value, information concerning

1 use of a flash, exposure information, type of camera, film
2 type, filter type, and other similar information. The patent
3 claims a camera that records such information with information
4 being recorded on the integrated circuit court. There is no
5 provision for changing the information or recording subsequent
6 information about the processing of the image nor is there
7 described a way to convey that information through many
8 generations of images.

9 Thus a need exists to provide a uniform tracking
10 mechanism for any type of image, using any type of image-
11 producing device, which can describe the full life-cycle of an
12 image and which can translate between one image state and
13 another and between one image forming mechanism and another.

14 **Summary of the Invention**

15 It is therefore an object of the present invention to
16 create an archival tracking method that includes relations,
17 descriptions, procedures, and implementations for universally
18 tracking images.

19 It is a further object of the present invention to create
20 an encoding schemata that can describe and catalogue any image
21 produced on any media, by any image producing device, that can
22 apply to all image producing disciplines.

23 It is a further object of the present invention to
24 implement to archival scheme on automated data processing
25 means that exist within image producing equipment.

26 It is a further object of the present invention to apply

1 to all image-producing devices.

2 It is a further object of the present invention to
3 support simultaneous use of multiple types of image-producing
4 devices.

5 It is a further object of the present invention to
6 support simultaneous use of multiple image-producing devices
7 of the same type.

8 It is a further object of the present invention to
9 provide automatic parent-child encoding.

10 It is a further object of the present invention to track
11 image lineages and family trees.

12 It is a further object of the present invention to
13 provide a serial and chronological sequencing scheme that
14 uniquely identifies all images in an archive.

15 It is a further object of present invention to provide an
16 identification schemata that describes physical attributes of
17 all images in an archive.

18 It is a further object of the present invention to
19 separate classificatory information from tracking information.

20 It is a further object of the present invention to
21 provide an enumeration schemata applicable to an unlimited set
22 of media formats used in producing images.

23 It is a further object of the present invention to apply
24 the archival scheme to all stages of an image's life-cycle,
25 from initial formation to final form.

26 It is a further object of the present invention to create

1 self-generating archives, through easy assimilation into any
2 image-producing device.

3 It is a further object of the present invention to create
4 variable levels of tracking that are easily represented by
5 current and arriving barcode symbologies, to automate data
6 transmission across different technologies (e.g., negative to
7 digital to print).

8 These and other objects of the present invention will
9 become clear to those skilled in the art from the description
10 that follows.

11 **Brief Description of the Invention**

12 The present invention is a universal image tracking
13 method and apparatus for tracking and documenting images
14 through their complete life-cycle, regardless of the device,
15 media, size, resolution, etc., used in producing them.

16 Specifically, the automated system for image archiving
17 ("ASIA") encodes, processes, and decodes numbers that
18 characterize images and image related data. Encoding and
19 decoding takes the form of a 3-number association: 1) location
20 number (serial and chronological location), 2) image number
21 (physical attributes), and 3) parent number (parent-child
22 relations).

23 **Brief Description of the Drawings**

24 Figure 1. Invention

25 Figure 1A. Overview of original image input

26 Figure 1B. Overview of lineage information generation

1 Figure 2. Formal specification

2 Figure 3 Encoding

3 Figure 4 Decoding

4 Figure 5 Implementation

5 Figure 6 Parent-child tree

6 Figure 7 ASIA

7 **Detailed Description of the Invention**

8 The present invention is a method and apparatus for
9 formally specifying relations for constructing image tracking
10 mechanisms, and providing an implementation that includes an
11 encoding schemata for images regardless of form or the
12 equipment on which the image is produced.

13 Referring to Figure 1 an overview of the present
14 invention is shown. This figure provides the highest-level
15 characterization of the invention. Figure 1 itself represents
16 all components and relations of the ASIA.

17 **Reference conventions.** Since Figure 1 organizes all high-
18 level discussion of the invention, this document introduces
19 the following conventions of reference.

- 20 • Whenever the text refers to "the invention" or to
21 the, "*Automated System for Image Archiving*", it
22 refers to the aggregate components and relations
23 identified in Figure 1.
- 24 • Parenthesized numbers to the left of the image in
25 Figure 1 **Invention** represent **layers** of the
26 invention. For example, 'Formal specification'

1 represents the "first layer" of the invention.

2 In Figure 1 **Invention**, each box is a hierarchically
3 derived sub-component of the box above it. 'ASIA' is a sub-
4 component of 'Formal objects', which is a sub-component of
5 'Formal specification'. By implication, thus, ASIA is also
6 hierarchically dependent upon 'Formal specification.' The
7 following descriptions apply.

8 **Formal specification 1.** This represents (a) the formal
9 specification governing the creation of systems of
10 automatic image enumeration, and (b) all derived
11 components and relations of the invention's
12 implementation.

13 **Formal objects 2.** This represents implied or stated
14 implementations of the invention.

15 **ASIA 3.** This is the invention's implementation software
16 offering.

17 It is useful to discuss an overview of the present
18 invention as a framework for the more detailed aspects of the
19 invention that follow. Referring first to figure 1A an
20 overview of the original image input process according to the
21 present invention is shown. The user first inputs information
22 to the system to provide information on location, author, and
23 other record information. Alternatively, it is considered to
24 be within the scope of the present invention for the equipment
25 that the user is using to input the required information. In
26 this manner, data is entered with minimum user interaction.

1 This information will typically be in the format of the
2 equipment doing the imaging. The system of the present
3 invention simply converts the data via a configuration
4 algorithm, to the form needed by the system for further
5 processing. The encoding/decoding engine 12 receives the user
6 input information, processes into, and determines the
7 appropriate classification and archive information to be in
8 coded 14. The system next creates the appropriate
9 representation 16 of the input information and attaches the
10 information to the image in question 18. Thereafter the final
11 image is output 20, and comprises both the image data as well
12 as the appropriate representation of the classification or
13 archive information. Such archive information could be in
14 electronic form seamlessly embedded in a digital image or such
15 information could be in the form of a barcode or other
16 graphical code that is printed together with the image on some
17 form of hard copy medium.

18 Referring to figure 1B the operation of the system on an
19 already existing image is described. The system first
20 receives the image and reads the existing archival barcode
21 information 30. This information is input to the
22 encoding/decoding engine 32. New input information is
23 provided 36 in order to update the classification and archival
24 information concerning the image in question. This
25 information will be provided in most cases without additional
26 user intervention. Thereafter the encoding/decoding engine

1 determines the contents of the original barcoded information
2 and arrives at the appropriate encoded data and lineage
3 information 34. This data and lineage information is then
4 used by the encoding/decoding engine to determine the new
5 information that is to accompany the image 38 that is to be
6 presented together with the image in question. Thereafter the
7 system attaches the new information to the image 40 and
8 outputs the new image together with the new image related
9 information 42. In this fashion, the new image contains new
10 image related information concerning new input data as well as
11 lineage information of the image in question. Again, such
12 archive information could be in electronic form as would be
13 the case for a digital image or such information could be in
14 the form of a barcode or other graphical code that is printed
15 together with the image on some form of hard copy medium.

16 Referring to Figure 2 the formal relations governing
17 encoding 4, decoding 5, and implementation of the relations 6
18 are shown. Encoding and decoding are the operations needed to
19 create and interpret the information on which the present
20 invention relies. These operations in conjunction with the
21 implementation of the generation of the lineage information
22 give rise to the present invention. These elements are more
23 fully explained below.

24 **Encoding**

25 **Introduction.** This section specifies the formal relations
26 characterizing all encoding of the invention, as identified in

1 Figure 2 **Formal specification.**

2 Rather than using a "decision tree" model (e.g., a flow
3 chart), Figure 3 uses an analog circuit diagram. Such a
4 diagram implies the traversal of all paths, rather than
5 discrete paths, which best describes the invention's, encoding
6 relations.

7 **Component descriptions.** Descriptions of each component in
8 Figure 3 **Encoding** follow.

9 Apparatus input 301 generates raw, unprocessed image
10 data, such as from devices or software. Apparatus input could
11 be derived from image data, for example, the digital image
12 from a scanner or the negative from a camera system.

13 Configuration input 303 specifies finite bounds that
14 determine encoding processes, such as length definitions or
15 syntax specifications.

16 The resolver 305 produces characterizations of images.
17 It processes apparatus and configuration input, and produces
18 values for variables required by the invention.

19 Using configuration input, the timer 307 produces time
20 stamps. Time-stamping occurs in 2 parts:

21 The clock 309 generates time units from a mechanism. The
22 filter 311 processes clock output according to specifications
23 from the configuration input. Thus the filter creates the
24 output of the clock in a particular format that can be used
25 later in an automated fashion. Thus the output from the clock
26 is passed through the filter to produce a time-stamp.

1 User data processing 313 processes user specified
2 information such as author or device definitions, any other
3 information that the user deems essential for identifying the
4 image produced, or a set of features generally governing the
5 production of images.

6 Output processing 315 is the aggregate processing that
7 takes all of the information from the resolver, timer and user
8 data and produces the final encoding that represents the image
9 of interest.

10 **Decoding**

11 Referring to Figure 4 the relationships that characterize all
12 decoding of encoded information of the present invention are
13 shown. The decoding scheme shown in Figure 4 specifies the
14 highest level abstraction of the formal grammar characterizing
15 encoding. The set of possible numbers (the "language") is
16 specified to provide the greatest freedom for expressing
17 characteristics of the image in question, ease of decoding,
18 and compactness of representation. This set of numbers is a
19 regular language (i.e., recognizable by a finite state
20 machine) for maximal ease of implementations and computational
21 speed. This language maximizes the invention's applicability
22 for a variety of image forming, manipulation and production
23 environments and hence its robustness.

24 Decoding has three parts: location, image, and parent.
25 The "location" number expresses an identity for an image
26 through use of the following variables.

1	generation	Generation depth in tree structures.
2	sequence	Serial sequencing of collections or lots
3		of images.
4	time-stamp	Date and time recording for chronological
5		sequencing.
6	author	Creating agent.
7	device	Device differentiation, to name, identify,
8		and distinguish currently used devices
9		within logical space.
10	locationRes	Reserved storage for indeterminate future
11		encoding.
12	locationCus	Reserved storage for indeterminate user
13		customization.
14	The "image" number expresses certain physical attributes of an	
15	image through the following variables.	
16	category	The manner of embodying or "fixing" a
17		representation, e.g., "still" or "motion".
18	size	Representation dimensionality.
19	bit-or-push	Bit depth (digital dynamic range) or push
20		status of representation.
21	set	Organization corresponding to a collection
22		of tabular specifiers, e.g. a "Hewlett
23		Packard package of media tables.
24	media	Physical media on which representation
25		occurs.
26	resolution	Resolution of embodiment on media.

1	stain	Category of fixation-type onto media, e.g.
2		"color".
3	format	Physical form of image, e.g. facsimile,
4		video, digital, etc.
5	imageRes	Reserved storage for indeterminate future
6		encoding.
7	imageCus	Reserved storage for user customization.
8	The "parent" number expresses predecessor image identity	
9	through the following variables.	
10	time-stamp	Date, and time recording for chronological
11		sequencing.
12	parentRes	Reserved storage, for indeterminate future
13		encoding.
14	parentCus	Reserved storage, for indeterminate user
15		customization.

16. Any person creating an image using "location," "image,"
 17 and "parent" numbers automatically constructs a
 18 representational space in which any image-object is uniquely
 19 identified, related to, and distinguished from, any other
 20 image-object in the constructed representational space.

21 **Implementation**

22 Referring to figure 5, the formal relations characterizing all
 23 implementations of the invention are shown. Three components
 24 and two primary relations characterize any implementation of
 25 the encoding and decoding components of the present invention.
 26 Several definitions of terms are apply.

1 "schemata" 51 are encoding rules and notations.

2 "engine " 53 refers to the procedure or procedures for
3 processing data specified in a schemata.

4 "interface" 55 refers to the structured mechanism for
5 interacting with an engine.

6 The engine and interface have interdependent relations,
7 and combined are hierarchically subordinate to schemata. The
8 engine and interface are hierarchically dependent upon
9 schemata.

10 **Formal objects**

11 The present invention supports the representation of (1)
12 parent-child relations, (2) barcoding, and (3) encoding
13 schemata. While these specific representations are supported,
14 the description is not limited to these representations but
15 may also be used broadly in other schemes of classification
16 and means of graphically representing the classification data.

17 **Parent-child implementation**

18 Parent-child relations implement the 'schemata' and 'engine'
19 components noted above. The following terms are used in
20 conjunction with the parent child implementation of the
21 present invention:

22 "conception date" means the creation date/time of image.

23 "originating image" means an image having no preceding
24 conception date.

25 "tree" refers to all of the parent-child relations
26 descending from an originating image.

1 "node" refers to any item in a tree.
2 "parent" means any predecessor node, for a given node.
3 "parent identifier" means an abbreviation identifying the
4 conception date of an image's parent.
5 "child" means a descendent node, from a given node.
6 "lineage" means all of the relationships ascending from a
7 given node, through parents, back to the originating
8 image.
9 "family relations" means any set of lineage relations, or
10 any set of nodal relations.

11 A conventional tree structure describes image relations.

12 **Encoding**

13 Database software can trace parent-child information, but
14 does not provide convenient, universal transmission of these
15 relationships across all devices, media, and technologies that
16 might be used to produce images that rely on such information.
17 ASIA provides for transmission of parent-child information
18 both (1) inside of electronic media, directly; and (2) across
19 discrete media and devices, through barcoding.

20 This flexibility implies important implementational
21 decisions involving time granularity and device production
22 speed.

23 **Time granularity & number collision.** This invention
24 identifies serial order of children, (and thus parents) through
25 date- and time-stamping. Since device production speeds for
26 various image forming devices vary across applications, e.g.

1 from seconds to microseconds, time granularity that is to be
2 recorded must at least match device production speed. For
3 example, a process that takes merely tenths of a second must
4 be time stamped in at least tenths of a second.

5 In the present invention any component of an image
6 forming system may read and use the time stamp of any other
7 component. However, applications implementing time-stamping
8 granularities that are slower than device production speeds
9 may create output collisions, that is, two devices may produce
10 identical numbers for different images. Consider an example
11 in which multiple devices would process and reprocess a given
12 image during a given month. If all devices used year-month
13 stamping, they could reproduce the same numbers over and over
14 again.

15 The present invention solves this problem by deferring
16 decisions of time granularity to the implementation.
17 Implementation must use time granularity capable of capturing
18 device output speed. Doing this eliminates all possible
19 instances of the same number being generated to identify the
20 image in question. In the present invention, it is
21 recommended to use time intervals beginning at second
22 granularity, however this is not meant to be a limitation but
23 merely a starting point to assure definiteness to the encoding
24 scheme. In certain operations, tenths of a second (or yet
25 smaller units) may be more appropriate in order to match
26 device production speed.

1 **Specification**

2 All images have parents, except for the originating image
3 which has a null ('O') parent. Parent information is recorded
4 through (1) a generation depth identifier derivable from the
5 generation field of the location number, and (2) a parent
6 conception date, stored in the parent number. Two equations
7 describe parent processing. The first equation generates a
8 parent identifier for a given image and is shown below.

9 **Equation 1: Parent identifiers.** A given image's parent
10 identifier is calculated by decrementing the location number's
11 generation value (i.e. the generation value of the given
12 image), and concatenating that value with the parent number's
13 parent value. Equation 1 summarizes this:

14
15
$$\text{parent identifier} = \text{prev}(\text{generation}) \cdot \text{parent} \quad (1)$$

16

17 To illustrate parent-child encoding, consider an image
18 identified in a given archive by the following key:

19 B0106-19960713T195913JSA:1-19 S135F-OFCEP00100S:2T-0123 19960613T121133

20 In this example the letter "B" refers to a second
21 generation. The letter "C" would mean a third generation and
22 so forth. The numbers "19960713" refers to the day and year of
23 creation, in this case July 13, 1996. The numbers following
24 the "T" refers to the time of creation to a granularity of
25 seconds, in this case 19:59:13 (using a 24 hour clock). The
26 date and time for the production of the parent image on which
27 the example image relies is 19960613T121133, or June 13, 1996

1 at 12:11:33.

2 Equation 1 constructs the parent identifier:

3

```

1      parent identifier = prev(generation) * parent
2      or,
3      parent identifier = prev(B) * (19960613T121133)
4                      = A * 19960613T121133
5                      = A19960613T121133

```

7 The location number identifies a B (or "2nd") generation
 8 image. Decrementing this value identifies the parent to
 9 be from the A (or "1st") generation. The parent number
 10 identifies the parent conception date and time,
 11 (19960613T121133). Combining these, yields the parent
 12 identifier A19960613T121133, which uniquely identifies
 13 the parent to be generation A, created on 13 June 1996 at
 14 12:11:13PM (T121133).

15 Equation 2 evaluates the number of characters needed to
 16 describe a given image lineage.

17 **Equation 2: Lineage lengths.** Equation 2 calculates the number
 18 of characters required to represent any given generation depth
 19 and is shown below:

```

21      lineage = len(key) + (generation -1) * len( parent ) (2)
22      length      ( depth )      ( identifier )
23

```

24 **Example: 26 generations, 10⁹ family relations.** Providing a 26
 25 generation depth requires a 1 character long definition for
 26 generation (i.e. A-Z). Providing 1000 possible
 27 transformations for each image requires millisecond time

1 encoding, which in turn requires a 16 character long parent
2 definition (i.e. gen. 1-digit, year-4 digit, month 2-digit,
3 day 2-digit, hour 2-digit, min. 2-digit, milliseconds 3-
4 digit). A 1 character long generation and 16 character long
5 parent yield a 17 character long parent identifier.

6 Referring to Figure 6, the parent child encoding of the
7 present invention is shown in an example form. The figure
8 describes each node in the tree, illustrating the present
9 invention's parent-child support.

10 601 is a 1st generation original color transparency.

11 603 is a 2nd generation 3x5 inch color print, made from
12 parent 601.

13 605 is a 2nd generation 4x6 inch color print, made from
14 parent 601.

15 607 is a 2nd generation 8x10 inch color internegative,
16 made from parent 601.

17 609 is a 3rd generation 16x20 inch color print, made from
18 parent 607.

19 611 is a 3rd generation 16x20 inch color print, 1 second
20 after 609, made from parent 607.

21 613 is a 3rd generation 8x10 inch color negative, made
22 from parent 607.

23 615 is a 4th generation computer 32x32 pixel RGB
24 "thumbnail" (digital), made from parent 611.

25 617 is a 4th generation computer 1280x1280 pixel RGB
26 screen dump (digital), 1 millisecond after 615, made

1 from parent 611.

2 619 is a 4th generation 8.5x11 inch CYMK print, from
3 parent 611.

4 This tree (Figure 6) shows how date- and time-stamping of
5 different granularities (e.g., nodes 601, 615, and 617)
6 distinguish images and mark parents. Thus, computer screen-
7 dumps could use millisecond accuracy (e.g., 615, 617), while a
8 hand-held automatic camera might use second granularity (e.g.,
9 601). Such variable date- and time-stamping guarantees (a)
10 unique enumeration and (b) seamless operation of multiple
11 devices within the same archive.

12 Applications

13 The design of parent-child encoding encompasses several
14 specific applications. For example, such encoding can provide
15 full lineage disclosure, and partial data disclosure.

16 Application 1: Full lineage disclosure, partial data 17 disclosure

18 Parent-child encoding compacts lineage information into parent
19 identifiers. Parent identifiers disclose parent-child
20 tracking data, but do not disclose other location or image
21 data. In the following example a given lineage is described
22 by (1) a fully specified key (location, image, and parent
23 association), and (2) parent identifiers for all previous
24 parents of the given key. Examples illustrates this design
25 feature.

26 Example 1: 26 generations, 10⁷⁹ family relations.

Providing a 26 generation depth requires a 1 character long definition for generation. Providing 1000 possible transformations for each image requires millisecond time encoding, which in turn requires a 16 character long parent definition. A 1 character long generation and 16 character long parent yield a 17 character long parent identifier (equation 1).

Documenting all possible family relations requires calculating the sum of all possible nodes. This is a geometric sum increasing by a factor of 1000 over 26 generations. The geometric sum is calculated by the following equation:

$$\text{sum} = \frac{\text{factor}^{(\text{generations} + 1)} - 1}{\text{factor} - 1} \quad (3)$$

or,

$$\begin{aligned} \text{sum} &= \frac{1000^{(26+1)} - 1}{1000 - 1} \\ &= \frac{10^{81} - 1}{999} \\ &= 1.00 \cdot 10^{79} \end{aligned}$$

For 26 generations, having 1000 transformations per image, the geometric sum yields 10^{79} possible family relations. To evaluate the number of characters needed to represent a maximum lineage encoded at millisecond accuracy across 26 generations, the following equation is used (noted earlier):

```
1      lineage = len(key) + (generation) -1 * len( parent )
2      length   ( depth )      (identifier)
3
4      or,
```

```

1           lineage   = (100) + (26 - 1) * (17)
2           length
3           =         525
4

```

5

6 Thus, the present invention uses **525 characters** to encode
7 the maximum lineage in an archive having 26 generations
8 and 1000 possible transformations for each image, in a
9 possible total of 10^{79} family relations.

10 **Example 2: 216 generations, 10^{649} family relations.** The
11 upper bound for current 2D symbologies (e.g., PDF417,
12 Data Matrix, etc.) is approximately 4000 alphanumeric
13 characters per symbol. The numbers used in this example
14 illustrate, the density of information that can be
15 encoded onto an internally sized 2D symbol.

16 Providing a 216 generation depth requires a 2 character
17 long definition for generation. Providing 1000 possible
18 transformations for each image requires millisecond time
19 encoding, which in turn requires a 16 character long
20 parent definition. A 2 character long generation and 16
21 character long parent yield an 18 character long parent
22 identifier. To evaluate the number of characters
23 needed to represent a maximal lineage encoded at
24 millisecond accuracy across 216 generations, we recall
25 equation 2:

```

26
27 lineage = len(key) + (generation) -1 * len( parent )
28 length   ( depth )      ( identifier)
29
30

```

or,

```

1      lineage = (100) + (216-1) * (18)
2      length
3          = 3970
4

```

5

6 In an archive having 216 generations and 1000 possible
 7 modifications for each image, a maximal lineage encoding
 8 requires **3970 characters**.

9 Documenting all possible family relations requires
 10 calculating the sum of all possible nodes. This is a
 11 geometric sum increasing by a factor of 1000 over 216
 12 generations. To calculate the geometric sum, we recall
 13 equation 3:

$$14 \quad \quad \quad \text{factor}^{(\text{generations}+1)} - 1$$

$$15 \quad \quad \quad \text{sum} = \frac{\quad}{\text{factor} - 1}$$

16
 17
 18 or,

$$19$$

$$20 \quad \quad \quad \frac{1000^{(216+1)} - 1}{1000 - 1}$$

$$21 \quad \quad \quad \text{sum} =$$

$$22$$

$$23$$

$$24 \quad \quad \quad = \frac{10^{651} - 1}{999}$$

$$25$$

$$26$$

$$27 \quad \quad \quad = 1.00 \cdot 10^{649}$$

$$28$$

29

30 For 216 generations, having 1000 transformations per
 31 image, the geometric sum yields 10^{641} **possible family**
 32 **relations**. Thus, this invention uses **3970 characters** to
 33 encode a maximal lineage, in an archive having 216
 34 generations and 1000 possible transformations for each
 35 image, in a possible total of 10^{649} family relations.

1 **Conclusion.** The encoding design illustrated in **Application 1:**
2 **Full lineage disclosure, partial data disclosure** permits exact
3 lineage tracking. Such tracking discloses full data for a
4 given image, and parent identifier data for a given image's
5 ascendent family. Such design protects proprietary
6 information while providing full data recovery for any lineage
7 by the proprietor.

8 A 216 generation depth is a practical maximum for 4000
9 character barcode symbols, and supports numbers large enough
10 for most conceivable applications. Generation depth beyond
11 216 requires compression and/or additional barcodes or the use
12 of multidimensional barcodes. Furthermore, site restrictions
13 may be extended independently of the invention's apparatus.
14 Simple compression techniques, such as representing numbers
15 with 128 characters rather than with 41 characters as
16 currently done, will support 282 generation depth and 10^{850}
17 possible relations.

18 **Application 2: Full lineage disclosure, full data disclosure**
19 In direct electronic data transmission, the encoding permits
20 full transmission of all image information without
21 restriction, of any archive size and generation depth. Using
22 2D+ barcode symbologies, the encoding design permits full
23 lineage tracking to a 40 generation depth in a single symbol,
24 based on a 100 character key and a theoretical upper bound of
25 4000 alphanumeric characters per 2D symbol. Additional
26 barcode symbols can be used when additional generation depth

1 is needed.

2 **Application 3: Non-tree-structured disclosure**

3 The encoding scheme of the present invention has extensibility
4 to support non-tree-structured, arbitrary descent relations.
5 Such relations include images using multiple sources already
6 present in the database, such as occurring in image overlays.

7 **Conclusion**

8 **Degrees of data disclosure.** The invention's design supports
9 degrees of data disclosure determined by the application
10 requirements. In practicable measures the encoding supports:

- 11 1. Full and partial disclosure of image data;
- 12 2. Lineage tracking to any generation depth, using
13 direct electronic data transmission;
- 14 3. Lineage tracking to restricted generation depth,
15 using barcode symbologies, limited only by symbology
16 size restrictions.

17 Further, ASIA supports parent-child tracking through
18 time-stamped parent-child encoding. No encoding restrictions
19 exist for electronic space. Physical boundaries within 2D
20 symbology space promote theoretical encoding guidelines,
21 although the numbers are sufficiently large so as to have
22 little bearing on application of the invention. In all
23 cases, the invention provides customizable degrees of data
24 disclosure appropriate for application in commercial,
25 industrial, scientific, medical, etc., domains.

26 **Barcoding implementation**

1 **Introduction.** The invention's encoding system supports
2 archival and classifications schemes for all image-producing
3 devices, some of which do not include direct electronic data
4 transmission. Thus, this invention's design is optimized to
5 support 1D-3D+ barcode symbologies for data transmission
6 across disparate media and technologies.

7 **1D symbology**

8 Consumer applications may desire tracking and retrieval
9 based on 1 dimensional (1D) linear symbologies, such as Code
10 39. Table 5 shows a configuration example which illustrates a
11 plausible encoding configuration suitable for consumer
12 applications.

13 The configuration characterized in Table 5 yields a
14 maximal archive size of 989,901 images (or 19,798 images a
15 year for 50 years), using a 4 digit sequence and 2 digit unit.
16 This encoding creates 13 character keys and 15 character long,
17 Code 39 compliant labels. A database holds full location,
18 image, and parent number associations, and prints convenient
19 location number labels, for which database queries can be
20 made.

21			
22	<generation>	=	1 character
23	<sequence>	=	4 digits
24	<date>	=	6 digits
25	<unit>	=	2 digits
26	constants	=	2 characters
27	<hr/>		
28	Total	=	15 characters
29			

30 Table 5: Configuration example

31

1 With such a configuration, a conventional 10 mil, Code 39
2 font, yields a 1.5 inch label. Such a label conveniently fits
3 onto a 2x2 inch slide, 3x5 inch prints, etc. Note, that this
4 encoding configuration supports records and parent-child
5 relations through a conventional "database key" mechanism, not
6 through barcode processing.

7 **Conclusion.** The ASIA implementation provides native 1D
8 symbology support sufficient for many consumer applications.
9 However, 2D symbology support is preferred since it guarantees
10 data integrity. 2D symbology also provides greater capacity
11 and so can support a richer set of functionality provided by
12 the ASIA.

13 **2D symbology**

14 Comprehensive tracking suitable for commercial,
15 industrial, and scientific applications is achievable
16 electronically, and/or through 2 dimensional (2D), stacked
17 matrix or full matrix symbologies, such as PDF417, Data
18 Matrix, etc. These symbologies have adequate capacity to
19 support complex implementations of the various archival and
20 classification schemes presented.

21 **Example application.** 2D symbology can support a rich set of
22 the present invention's encoding. The following examples
23 present some of the possibilities.

- 24 1. **Parent-child tracking.** 2D symbology can support
25 significant parent-child encoding including parent-child
26 relations, lineage, tracking mechanisms, and derivative

1 applications.

2 2. **Copyright protection.** Combined with certification
3 programs, 2D image encodings of this invention can
4 enhance copyright protection. Referential tracking to
5 production source can be provided on any image, which can
6 include partial or full disclosure of image data.
7 Encryption technologies can further enhance
8 authentication control.

9 3. **Migration paths.** 2D symbology also includes important
10 potential migration paths for encoding schemata in
11 commercial and industrial image management. 2D
12 applications may include arbitrary encryption; variable
13 sizing; Reed-Solomon error correction (e.g., providing
14 full data recovery with 50% symbol loss); printability
15 through ink, invisible ink, etching, embossing, exposing
16 (e.g., onto negatives or transparencies); and efficient
17 scan rates suitable for automated film processing
18 equipment.

19 In summary, 2D symbology can facilitate universal data
20 transmission, regardless of the producing technology; or data
21 transmission from any form of image-producing device to any
22 other form of image-producing device.

23 Further, the present invention provides viable 1D
24 symbology support at the implementation layer, and a specific
25 implementation with the ASIA software. However, with 1D
26 symbology the same number or classification being assigned to

1 different images is, in a 1D implementation, theoretically
2 possible.

3 Use of 2D symbology barcoding eliminates the possibility
4 of ambiguity resulting from the same classification or archive
5 identifiers being assigned to the same image and is therefore
6 preferred. The use of 2D symbology together with the
7 classification and archiving scheme of the present invention
8 can protect any granularity of proprietary image data; provide
9 unobtrusive labeling on prints or print description plates;
10 expose archival encoding directly onto media at exposure,
11 processing, and/or development time; and yield rapid data
12 collection through sorting machines for media, such as
13 transparencies, prints, etc. ASIA provides native support of
14 2D Data Matrix to facilitate such application development.

15 3D+ (holographic) symbologies will permit tracking
16 greater lineage depths in single symbols. Supporting this 3D
17 implementation requires no additional complexity to the
18 system.

19 **Schemata**

20 This section describes the invention's schemata, characterized
21 through the tables that follow. Tables 6 and 7, provide a
22 guide to the organization of schemata of the present
23 invention. Tables 9-17 describe the conventions, syntax, and
24 semantics of *location numbers*, *image numbers*, and *parent*
25 *numbers*. Tables 19-26 fully expand the semantics listed in
26 Table 13 entitled "Image semantics."

1 Table 6 (following) lists all tables that specify the
2 classification scheme of the present invention. In this
3 table, exact table names are identified together with a brief
4 description of each table which describes the contents of that
5 table.

6

1	Tables	Description
2	Table 9 Conventions	Conventions for all tables
3	Table 10 Syntax	Syntactic summaries
4	Table 11 Size/res. syntax	"
5	Table 12 Locations semantics	Semantic summaries
6	Table 13 Image semantics	"
7	Table 14 Parent semantics	"
8	Table 15 Measure semantics	"
9	Table 15 Software Packages	"
10	Table 16 Format semantics	"
11	Table 17 Size examples	Illustrations of size
12	Table 18 Resolution examples	"
13	Table 19 Reserved media slots	Specifics for Table 13
14	Table 20 Color transparency film	"
15	Table 21 Color negative film	"
16	Table 22 Black & White film	"
17	Table 23 Duplicating & internegative film	"
18	Table 24 Facsimile	"
19	Table 25 Prints	"
20	Table 26 Digital	"

Table 6: Schemata tables

24 Similarly, Table 7 (following) entitled "Table groupings"
 25 further groups the specification table by the categories in
 26 which they are discussed in the following pages.

28	Title	Table No.
29	Conventions:	Table 9
30	Syntax:	Tables 10-11
31	Semantics:	Tables 12-16
32	Examples:	Tables 17-18
33	Media:	Tables 19-26

Table 7: Table groupings

37 Conventions: Table 9

38 Table 9 entitled "Conventions" fully specifies the
 39 conventions governing all tabular information in the archival
 40 and classification scheme of the present invention. In Table

1 9, the column **Form** lists the conventions governing syntactic
2 items for all tables in of the present invention. Specific
3 conventions are the following.

- 4 • *Emphasized* words indicate variables.
- 5 • ROMAN words indicate constant or literal values.
- 6 • Angle-brackets <> indicate required material.
- 7 • Brackets [] indicate optional material.
- 8 • Parentheses () indicate logical groupings.
- 9 • Braces {} indicate regular expression modifiers.
- 10 • The bar '|' character indicates an alternative.
- 11 • The star '*' character indicates "0 or more".
- 12 • The plus '+' character indicates "1 or more".

13 The columns **Variables** comprehensively lists all variables
14 used in Appendix **Schemata**. Each variable represents a single
15 length character, so n represents any single digit (not any
16 number of any digit). Specific variables are:

- 17 • 'l' indicates any alphabetical character a-z
- 18 • 'n' indicates any number 0-9
- 19 • 'c' indicates any alphabetical character a-z,
20 or a number 0-9
- 21 • 'y' indicates a digit used to construct the
22 year
- 23 • 'm' indicates a digit used to construct the
24 month
- 25 • 'd' indicates a digit used to construct the day
- 26 • 'h' indicates a digit used to construct the

hour

- 't' indicates a digit used to construct the minute
- 's' indicates a digit used to construct the second
- 'i' indicates a digit used to construct a fractional second.

Table 9: Conventions

Form	Description	Variables	Description
<i>emphasis</i>	variable	<i>l</i>	letter
ROMAN	constant	<i>n</i>	number
< >	required	<i>c</i>	class <i>ln</i>
[]	optional		
()	grouping	<i>y</i>	year
{ }	modifier	<i>m</i>	month
	alteration	<i>d</i>	day
*	0 or more	<i>h</i>	hour
+	1 or more	<i>t</i>	minute
		<i>s</i>	second
		<i>i</i>	fractional second

Syntax: Tables 10-11

Tables 10-11 strictly conform to the syntactic rules of Table 9 Conventions (above). Specifics are described according to two logical divisions:

1. ¶Location, image, & parent syntax. This is described in Table 10 entitled "Syntax." Table 10 Syntax

1 provides a compact summary of the present invention's
2 functionality.

3 2. **Size & resolution syntax.** This is described in
4 Table 11 entitled "Size/res. syntax." Table 11 **Size/res.**
5 **syntax** expands the syntax rules for the variable *size* and
6 *resolution*, introduced in Table 10.

7 **Location, image & parent syntax.** In Table 10 **Syntax**, the rows
8 assigned to **Location**, **Image** and **Parent** respectively provide:

- 9 1. An example of a number ('Example'), showing small
10 and large illustrations of the schemata.
- 11 2. The names of each field used by a number ('Names').
- 12 3. The specific syntactic rules governing a
13 number('Syntax').

14 The columns identify the type of number ('#'), category, and
15 row illustration.

16 The association of a *location number* and *image number*
17 guarantees a unique identification of every image in an
18 archive. The association of a *location number*, *image number*,
19 and *parent number* guarantees unique identification and fully
20 recoverable parent-child relations.

21 **Location numbers** track serial and chronological location.
22 Specific fields are (a) required entries *generation*, *sequence*,
23 and *date*; and (b) optional entries *time*, *author*, *device*, *unit*,
24 *locationRes*, and *locationCus*. The required entries guarantee
25 minimal tracking information and data consistency for basic
26 electronic sorting, while the optional entries provide

1 additional granularity for high volume tracking (there are no
2 theoretical size limitations).

3 **Image numbers** track primarily physical attributes of
4 images across devices, media types, and storage conditions.
5 Specific fields are (a) required entries *category size*, *media*,
6 *push or bit*, *resolution*, *stain*, and *format*; and (b) optional
7 entries, *imageRes* and *imageCus*. Either *push or bit* is always
8 required, but both are never permissible. The *format* field
9 determines whether *push or bit* is used: *bit* is used when
10 *format* is digitally related, otherwise *push* is used.

11 **Parent numbers** track the date and time of parent
12 conception, and optional data. Specific fields are (a) the
13 required entry *parent*, and (b) optional entries *parentRes* and
14 *parentCus*. The required entry encodes parent information for
15 a given child image, while the optional entries provide
16 specification extension and user customization.

Table 10: Syntax

#	Category	Illustration
Location	Example: Names: Syntax:	small: A1040-199609; large: A1011-19920417T05365699CPG@2-12345:A1.Z2 <generation> <sequence> <date> [time] [device] [unit] [locationCus] </(+)> <n{+}> <yyyymm[dd] [T hhrf[ss[+]]] [I(+)] [c{+}]
Image	Example: Names: Syntax:	small: S135+1KCAM@0200S:2T; large: S135F-024GIF8@HP@0300DI:6D:1A2B.5E <category> <size> <[push]> [bit]> <media> [set] <resolution> <unit> <format> [imageRes] [imageCus] </(+)> <nc(*)> <[(+)+n(+)] [n(+)]> <lc(*)> [c{+}] @c{+} @<c{+}> <n{+}> <n{+}> <n{+}> [c{+}]
Parent	Example: Names: Syntax:	19961231T235959; large: 19961231T23595999 <parent> <parentRes> <parentCus> <yyyymm[dd]>[T hhrf[ss[+]]] [c{+}] [c{+}]
		NB: Second accuracy is minimally recommended for parent-child encoding. Both (a) parent and (b) Location's date and time should use the same specification.

NB: Second accuracy is minimally recommended for parent-child encoding. Both (a) parent and (b) Location's date and time should use the same specification when possible.

Size & resolution syntax. Table 11 **Size/res. syntax** specifies syntactic rules governing the variables *size* and *resolution*, previously introduced in Table 10. Table 11 describes how the variables *size* and *resolution* express (a) dimension and (b) units of measure.

The row 'Names' indicates variable names, such as '<measure>' for the unit of measure. 'Syntax 1' and 'Syntax 2' are the canonical syntaxes.

Table 11: Size/res. syntax

Category	Illustration			
Names	<dimension>			<measure>
Syntax 1	<c{+}>			<lc{*}>
Names	<X-dimension>	X	<Y-dimension>	<measure>
Syntax 2	<n{+}>	X	<n{+}>	<lc{*}>

NB: Variables *size* and *resolution* use either syntax form. Table 15 **Measure Semantics** lists *measure* values. Table 17 **Size examples** and 18 **Resolution examples** provide illustrations.

Semantics: Tables 12-16

Introduction. Tables 12-16 describe semantic conventions, and fully specify the syntactic rules of Tables 10-11. Values for all variables are case insensitive. Tables 12-16 describe the meanings of syntactic names, literal values, descriptions of syntactic elements, and lengths of all fields. Specifics are described according to the following conceptual divisions.

Location semantics	Table 12
Image semantics	Table 13
Parent semantics	Table 14

1 Measure semantics Table 15

2 Format semantics Table 16

3 **Location semantics.** In Table 12 **Location semantics**, **Location**
4 indicates the location number classification. The column **Name**
5 indicates the name of a given location number *field*, while the
6 column **Description**, describes what a *field* means. For
7 example, the field <date> within the classification **Location**,
8 describes the date when the lot was made.

9 In the next column of Table 12, **Syntax**, Table 10's row
10 **Syntax** is relisted in vertical form. The column **Literal** lists
11 the corresponding values or ranges of permissible values. For
12 example, the **Syntax** '-yyyy' for the field <date> literally
13 expands into a permissible range of 0000-9,999 years. The
14 next column **Description**, describes what the legal value means.
15 For example, 'yyyy' is the year.

16 Finally, the column **Length** indicates the permissible
17 length of a given argument. For example, in the <date> field,
18 a minimum of 7 characters is required, and a maximum of 9
19 characters is
20 permissible.

Table 12: Location semantics

Legal Values						
#	Name	Description	Syntax	Literal	Description	Length
Location	<generation>	Lot generation	l{+}	A-Z AA-ZZ ..	A = 1st AA = 27 th etc.	1+
	<sequence>	Sequence in archive	n{+}	0-9 0000-9999 ..	Lot number etc.	1+
	<date>	Date made (ISO 8601:1988 compliant)	-yyyy mm [dd]	0000-9999 01-12 01-31	Year Month Day	7 [9]
	[time]	Time made (ISO 8601:1988 compliant, plus any fractional second)	[T hh tt [ss [i{+}]]]	00-23 00-59 00-59 0-9	Hour Minute Second Fractional second	[5+]
	[author]	Author	[lc{*}]	a-zA-Z ..	Author's name etc.	[1+]
	[device]	Device used	[@c{+}]	0-9 ..	Device number etc.	[2+]
	[unit]	Image in Lot	[-n{+}]	0-9 0000-9999 ..	Image number etc.	[2+]
	[locationRes]	Unspecified	[:c{+}]	a-zA-Z0-9	Future use	[2+]
	[locationCus]	Unspecified	[:c{+}]	a-zA-Z0-9	User Customization	[2+]
					Total	9 [-25+]

1 **Image semantics.** In Table 13 **Image semantics**, **Image** indicates
 2 the image number classification. The column **Name** indicates
 3 the name of a given image number *field*, while the column
 4 **Description** describes what a *field* means. For example, the
 5 field *<category>* describes the category of the image number.

6 In the next column of Table 13, **Syntax**, Table 10's row
 7 **Syntax** is relisted in vertical form. The next column **Literal**,
 8 lists the corresponding values or ranges of permissible
 9 values. The next column **Description**, describes what the
 10 **Literal** value means. Finally, the column **Length** indicates the
 11 permissible length of a given argument. For example, the
 12 *<size>* field uses 1 or more characters.

Table 13: Image semantics

Legal Values						
#	Name	Description	Syntax	Literal	Description	Length
Image	<i><category></i>	Category	<i>1{+}</i>	S	Single Frame	1+
				M	Motion Picture	
	<i><size></i>	Image or film size	<i>nc{*}</i>	(See Table 11	Size/res. syntax)	1+
				(See Table 15	Measure semantics)	
				(See Table 18	Size examples)	
	<i><push </i>	Exposure	<i><(-+){+} </i>	0	No push ('+' = up)	<i><2+ </i>
				3	3 stops ('-' = down)	
				..	etc.	
	<i>bit></i>	Dynamic range	<i>-n{+}></i>	0-9	E.g. 8=8 bit	2+>
		("bit depth")		..	etc.	

#	Name	Description	Syntax	Literal	Description	Length
1	<media>	Image media	lc{*}	(See Table 20	Reserved)	
2				(See Table 21	Slides)	2+
3				(See Table 22	Negatives)	
4				(See Table 23	B&W)	
5				(See Table 24	Dups & Internegs	
6				(See Table 25	Facsimiles)	
7				(See Table 26	Prints)	
				(See Table 27	Digital)	
8	[set]	Package	[@c{+}]	(See Table 17	Packages)	
9	<resolution>	Resolution	@c{+}	(See Table 11	Size/res. syntax	2+
10				(See Table 15	Measure semantics	
				(See Table 19	Resolution examples	
11	<stain>	Presentation form ("bit depth")	n{+}	0	Black & White	1+
12				1	Gray scale	
13				2	Color	
14				3	RGB (Red,Gm,Blu)	
15				4	YIQ (RGB TV	
16					variant)	
17				5	CYMK	
18					(Cyn,Yel,Mag,Blk)	
19				6	HSB (Hue, Sat,	
20					Bright)	
21				7	CIE (Commission	
22					de l'Eclairage)	
23				8	LAB	
24					etc.	
25						
26	<format>	Image form	lc{*}	(See Table 16	Format semantics)	1+

#	Name	Description	Syntax	Literal	Description	Length
1	{imageRes}	Unspecified	[.c{+}]	a-zA-Z0-9	Future use	[2+]
	{imageCus}	Unspecified	[.c{+}]	a-zA-Z0-9	User customization	[2+]
2	Total 10[-16+]					

3

4 **Parent semantics.** In Table 14 Parent semantics, **Parent**

5 indicates the parent number classification. The column **Name**

6 indicates the name of a given parent number field, while the

7 column **Description** describes what a given *field* means. For

8 example, the field <parentRes> is a reserved field for future

9 use.

10 In the next column of Table 14, **Syntax**, Table 10's row

11 **Syntax** is relisted in vertical form. The next column **Literal**,

12 lists the corresponding values or ranges of permissible

13 values. The next column **Description**, describes what the

14 **Literal** value means. Finally, the column **Length** indicates the

15 permissible length of a given argument. For example, the

16 <parent> field uses 6 or more characters.

17 **Measure semantics.** Table 15 **Measure semantics** specifies legal

18 values for the variables *size* and *resolution*, previously

19 described by the rules in Table 11 **Size/res. syntax**.

Table 14: Parent semantics

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Legal Values

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#	Name	Description	Syntax	Literal	Description	Length
Parent	<parent>	Parent	yyyyymm[dd] [Thhmm[ss(i{+})]]	0-9 0-9T0-9	Date/time	6+
	[parentRes]	Unspecified	[c{+}]	a-zA-Z0-9	Future use	[1+]
	[parentCus]	Unspecified	[c{+}]	a-zA-Z0-9	User customization	[1+]
						Total
6 [-8+]						

The column **Category** identifies which values are shared by size and resolution and which are unique. The column **Literal** lists the abbreviations used in size and resolution values. The column **Description** expands the abbreviations into their corresponding names.

Table 15: Measure semantics

Category	Literal	Description
Shared	DI	Dots per inch (dpi)
	DE	Dots per foot (dpe)
	DY	Dots per yard (dpy)
	DC	Dots per centimeter (dpc)
	DM	Dots per millimeter (dpm)
	DP	Dots per pixel (dpp)
	DT	Dots per meter (dpt)
	M	Millimeters
	C	Centimeters
	T	Meters
	I	Inches
	E	Feet
	Y	Yard
	P	Pixel
	L	Lines
	R	Rows
	O	Columns
	B	Columns & Rows
	. .	etc.
Size	F	Format
Unique	. .	etc.
Res. Unique	S	ISO
	. .	etc.

Format semantics. Table 16 Format semantics specifies legal values for the variable format, previously described in Table 13 Image semantics. The **Literal** column lists legal values and

the **Description** column expands the abbreviations into their corresponding names.

Table 16: Format semantics

<u>Literal</u>	<u>Description</u>
A	Audio-visual
C	Photocopy
D	Digital
F	Facsimile
L	Plotter
M	MRI
N	Negative
P	Print
R	Vector graphics
T	Transparency
V	Video
X	X-radiographic
..	etc.

Table 17: Packages

<u>Literal</u>	<u>Description</u>
3C	3Com
3M	3M
AD	Adobe
AG	AGFA
AIM	AIMS Labs
ALS	Alesis
APP	Apollo
APL	Apple
ARM	Art Media
ARL	Artel
AVM	Aver Media Technologies
ATT	AT&T
BR	Bronica
BOR	Borland
CN	Canon
CAS	Casio
CO	Contax
CR	Corel
DN	Deneba
DL	DeLorme
DI	Diamond
DG	Digital
DIG	Digitech

1	EP	Epson
2	FOS	Fostex
3	FU	Fuji
4	HAS	Hasselblad
5	HP	Hewlett Packard
6	HTI	Hitachi
7	IL	Ilford
8	IDX	IDX
9	IY	Iiyama
10	JVC	JVC
11	KDS	KDS
12	KK	Kodak
13	KN	Konica
14	IBM	IBM
15	ING	Intergraph
16	LEI	Leica
17	LEX	Lexmark
18	LUC	Lucent
19	LOT	Lotus
20	MAM	Mamiya
21	MAC	Mackie
22	MAG	MAG Innovision
23	MAT	Matrox Graphics
24	MET	MetaCreations
25	MS	Microsoft
26	MT	Microtech
27	MK	Microtek
28	MIN	Minolta
29	MTS	Mitsubishi
30	MCX	Micrografx
31	NEC	NEC
32	NTS	Netscape
33	NTK	NewTek
34	NK	Nikon
35	NS	Nixdorf-Siemens
36	OLY	Olympus
37	OPC	Opcode
38	OR	O'Reilly
39	PAN	Panasonic
40	PNC	Pinnacle
41	PNX	Pentax
42	PO	Polaroid
43	PRC	Princeton Graphics
44	QT	Quicktime
45	ROL	Roland
46	RO	Rollei
47	RIC	Ricoh
48	SAM	Samsung
49	SAN	SANYO
50	SHA	Sharp
51	SHI	Shin Ho
52	SK	Softkey
53	SN	Sony
54	SUN	SUN
55	TAS	Tascam
56	TEAC	TEAC

TKX Tektronix
 TOS Toshiba
 ULS Ulead systems
 UMX UMAX
 VWS ViewSonic
 VID Videonics
 WG Wang
 XX Unknown
 XE Xerox
 YAS Yashica
 YAM Yamaha

Table 18: Size examples

Literal	Dimension	Measure
Syntax 1	135F	35mm format
	120F	Medium format
	220F	Full format
	4X5F	4x5 format
	..	etc.
Syntax 2	9X14C	9x14 centimeter
	3X5I	3x5 inch
	4X6I	4x6 inch
	5X7I	5x7 inch
	8X10I	8x10 inch
	11X14I	11x14 inch
	16X20I	16x20 inch
	20X24I	20x24 inch
	24X32I	24x32 inch
	24X36I	24x36 inch
	32X40I	32x40 inch
	40X50I	40x50 inch
	50X50I	50x50 inch
	40X50P	40X50 pixels
	100X238P	100X238 pixels
	1024X1280P	1024X1280 pixels
	A4S	210x297mm sheet
	A5S	148x210mm sheet
	JIS B5S	182x257mm sheet
	LETTERS	8.5x11in sheet
	LEGALS	8.5x14in sheet
	EXECUTIVES	7.25x10.5in sheet
	..	etc.

Examples: Tables 18-19

Size & resolution examples. Table 18 Size examples

illustrates typical size values, and Table 19 Resolution

examples illustrates typical resolution values.

Values in these tables represent limited defaults since

size and resolution are algorithmically generated from the rules contained in Table 11 *Size/res. syntax*, and from the values contained in Table 15 *Measure semantics*. See *Size & resolution syntax* for details.

Table 19: Resolution examples

Literal	Dimension	Measure
Syntax 1	50S	50
	200S	200
	300DC	600
	1200DI	1200

Syntax 2	640X768P	640X768
	1024X1280P	1024X1280
	1280X1600P	1024X1280

Media: Tables 20-27

Table 20-27 specify the supported *media* listed in Table 13 *Image semantics*. Values of *media* are tied to values of *format*, so any *format* value may have its own *media* table. Since *format* is unlimited in size, *media* support is also unlimited.

Tables 20-24: Film Media. In Tables 20-24, the first character represents film manufacturers in the following ways:

- 'A' represents Agfa
- 'F' represents Fuji
- 'I' represents Ilford
- 'C' represents Konica
- 'K' represents Kodak
- 'P' represents Polaroid

- 1 • 'S' represents Seattle Film Works
 - 2 • 'T' represents 3M
 - 3 • 'X' represents an unknown film manufacturer
- 4 This leaves 17 slots for additional major film manufacturers,
5 before a single first letter prefix must represent multiple
6 manufacturers, or before additional letters must be added.
- 7 Any
- 8 number of film media may be supported, but 223 defaults are
- 9 provided in the preferred embodiment of the present invention.

Table 20: Reserved media slots

Reserved For	Literal	Description
Unknown	XXXX	Unknown film
User	UX0	Customization
	UX1	"
	UX2	"
	UX3	"
	UX4	"
	UX5	"
	UX6	"
	UX7	"
	UX8	"
	UX9	"
Specification	UR0	For future use
	UR1	"
	UR2	"
	UR3	"
	UR4	"
	UR5	"
	UR6	"
	UR7	"
	UR8	"
	UR9	"

Table 21: Color Transparency film

Company	Literal	Description
Agfa	AASC	Agfa Agfapan Scala Reversal (B&W)
	ACRS	Agfa Agfachrome RS
	ACTX	Agfa Agfachrome CTX
	ARSX	Agfa Agfacolor Professional RSX Reversal
Fuji	FCRTP	Fuji Fujichrome RTP
	FCSE	Fuji Fujichrome Sensia
	FRAP	Fuji Fujichrome Astia
	FRDP	Fuji Fujichrome Provia Professional 100
	FRPH	Fuji Fujichrome Provia Professional 400
	FRSP	Fuji Fujichrome Provia Professional 1600
	FRTTP	Fuji Fujichrome Professional Tungsten
	FRVP	Fuji Fujichrome Velvia Professional
Ilford	IICC	Ilford Ilfochrome
	IICD	Ilford Ilfochrome Display
	IICM	Ilford Ilfochrome Micrographic
Konica	CAPS	Konica APS JX
	CCSP	Konica Color Super SR Professional
Kodak	K5302	Kodak Eastman Fine Grain Release Positive Film 5302
	K7302	Kodak Fine Grain Positive Film 7302
	KA2443	Kodak Aerochrome Infrared Film 2443
	KA2448	Kodak Aerochrome II MS Film 2448
	KE100SW	Kodak Ektachrome Professional E100SW Film

1	KE100S	Kodak Ektachrome Professional E100S Film
2	KE200	Kodak Ektachrome Professional E200 Film
3	KEEE	Kodak Ektachrome Elite
4	KEEO100	Kodak Ektachrome Electronic Output Film 100
5	KEEO200	Kodak Ektachrome Electronic Output Film
6	KEEO64T	Kodak Ektachrome Electronic Output Film 64T
7	KEEP	Kodak Ektachrome E Professional
8	KEES	Kodak Ektachrome ES
9	KEEW	Kodak Ektachrome EW
10	KEIR	Kodak Ektachrome Professional Infrared EIR
11		Film
12	KEK	Kodak Ektachrome
13	KELL	Kodak Ektachrome Lumiere Professional
14	KELX	Kodak Ektachrome Lumiere X Professional
15	KEPD	Kodak Ektachrome 200 Professional Film
16	KEPF	Kodak Ektachrome Professional
17	KEPH	Kodak Ektachrome Professional P1600 Film
18	KEPJ	Kodak Ektachrome 320T Professional Film,
19		Tungsten
20	KEPL400	Kodak Ektachrome Professional 400X Film
21	KEPL	Kodak Ektachrome 200 Professional Film
22	KEPL	Kodak Ektachrome Plus Professional
23	KEPN	Kodak Ektachrome 100 Professional Film
24	KEPO	Kodak Ektachrome P Professional
25	KEPR	Kodak Ektachrome 64 Professional
26	KEPT	Kodak Ektachrome 160T Professional Film,
27		Tungsten
28	KEPY	Kodak Ektachrome 64T Professional Film, Tungsten
29	KETP	Kodak Ektachrome T Professional
30	KETT	Kodak Ektachrome T
31	KEXP	Kodak Ektachrome X Professional
32	KCCR	Kodak Kodachrome
33	KPKA	Kodak Kodachrome Professional 64 Film
34	KPKL	Kodak Kodachrome Professional 200 Film
35	KPKM	Kodak Kodachrome Professional 25
36	KVSSO279	Kodak Film Vericolor Slide Film SO-279
37	KVS	Kodak Vericolor Slide Film
38	Polaroid PPCP	Polaroid Professional High Contrast
39		Polychrome
40	Reserved --	See Table 20
41	Seattle Film	
42	Works	Seattle Film Works
43	3M	3M ScotchColor Slide
44		3M ScotchColor T slide
45		
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Table 22: Color negative film

Company	Literal	Description
Agfa	ACOP	Agfa Agfacolor Optima
	AHDC	Agfa Agfacolor HDC
	APOT	Agfa Agfacolor Triade Optima Professional
	APO	Agfa Agfacolor Professional Optima
	APP	Agfa Agfacolor Professional Portraita
	APU	Agfa Agfacolor Professional Ultra
	APXPS	Agfa Agfacolor Professional Portrait XPS
	ATPT	Agfa Agfacolor Triade Portraita Professional
	ATUT	Agfa Agfacolor Triade Ultra Professional
Fuji	FHGP	Fuji Fujicolor HG Professional

1		FHG	Fuji Fujicolor HG
2		FNHG	Fuji Fujicolor NHG Professional
3		FNPH	Fuji Fujicolor NPH Professional
4		FNPL	Fuji Fujicolor NPL Professional
5		FNPS	Fuji Fujicolor NPS Professional
6		FPI	Fuji Fujicolor Print
7		FPL	Fuji Fujicolor Professional, Type L
8		FPO	Fuji Fujicolor Positive
9		FRG	Fuji Fujicolor Reala G
10		FR	Fujicolor Reala
11		FSGP	Fuji Fujicolor Super G Plus
12		FSG	Fuji Fujicolor Super G
13		FSHG	Fuji Fujicolor Super HG 1600
14		FS	Fuji Fujicolor Super
15	Kodak	K5079	Kodak Motion Picture 5079
16		K5090	Kodak CF1000 5090
17		K5093	Kodak Motion Picture 5093
18		K5094	Kodak Motion Picture 5094
19		KA2445	Kodak Aerocolor II Negative Film 2445
20		KAPB	Advantix Professional Film
21		KCPT	Kodak Kodacolor Print
22		KEKA	Kodak Ektar Amateur
23		KEPG	Ektapress Gold
24		KEPPR	Kodak Ektapress Plus Professional
25		KGOP	Kodak Gold Plus
26		KGO	Kodak Gold
27		KGPX	Kodak Ektacolor Professional GPX
28		KGTX	Kodak Ektacolor Professional GTX
29		KPCN	Kodak Professional 400 PCN Film
30		KPHR	Kodak Ektar Professional Film
31		KPJAM	Kodak Ektapress Multispeed
32		KPJA	Kodak Ektapress 100
33		KPJC	Kodak Ektapress Plus 1600 Profession
34		KPMC	Kodak Pro 400 MC Film
35		KPMZ	Kodak Pro 1000 Film
36		KPPF	Kodak Pro 400 Film
37		KPRMC	Kodak Pro MC
38		KPRN	Kodak Pro
39		KPRT	Kodak Pro T
40		KRGD	Kodak Royal Gold
41		KVPS2L	Kodak Vericolor II Professional Type L
42		KVPS3S	Kodak Vericolor III Professional Type S
43		KVP	Kodak Vericolor Print Film
44	Konica	CCIP	Konica Color Impresa Professional
45		CIFR	Konica Infrared 750
46		CCSR	Konica SRG
47	Polaroid	POCP	Polaroid OneFilm Color Print
48	Reserved	--	See Table 20
49			
50			

Table 23: Black & white film
Description

Company	Literal	Description
Agfa	AAOR	Agfa Agfapan Ortho
	AAPX	Agfa Agfapan APX
	APAN	Agfa Agfapan
Ilford	IDEL	Ilford Delta Professional
	IFP4	Ilford FP4 PI
	IHP5	Ilford HP5 Plus
	IPFP	Ilford PanF Plus
	IPSF	Ilford SFX750 Infrared
	IUNI	Ilford Universal
	IOPP	Ilford XP2 Plus
Fuji	FNPN	Fuji Neopan
Kodak	K2147T	Kodak PLUS-X Pan Professional 2147, ESTAR Thick Base
	K2147	Kodak PLUS-X Pan Professional 2147, ESTAR Base
	K4154	Kodak Contrast Process Ortho Film 4154, ESTAR Thick Base
	K4570	Kodak Pan Masking Film 4570, ESTAR Thick Base
	K5063	Kodak TRI-X 5063
	KA2405	Kodak Double-X Aerographic Film 2405
	KAI2424	Kodak Infrared Aerographic Film 2424
	KAP2402	Kodak PLUS-X Aerographic II Film 2402, ESTAR Base
	KAP2412	Kodak Panatomic-X Aerographic II Film 2412, ESTAR Base
	KEHC	Kodak Ektagraphics HC
	KEKP	Kodak Ektapan
	KH13101	Kodak High Speed Holographic Plate, Type 131-01
	KH13102	Kodak High Speed Holographic Plate, Type 131-02
	KHSIET	Kodak High Speed Infrared, ESTAR Thick Base
	KHSIE	Kodak High Speed Infrared, ESTAR Base
	KHSI	Kodak High Speed Infrared
	KHSO253	Kodak High Speed Holographic Film, ESTAR Base SO-253
	KLPD4	Kodak Professional Precision Line Film LPD4
	KO2556	Kodak Professional Kodalith Ortho Film 2556
	KO6556	Kodak Professional Kodalith Ortho Film 6556, Type 3
	KPMF3	Kodak Professional Personal Monitoring Film, Type 3
	KPNMFA	Kodak Professional Personal Neutron Monitor Film, Type A
	KPXE	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion & Base
	KPXP	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion
	KPXT	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion & Base
	KPXX	Kodak Plus-X
	KPX	Kodak PLUS-X Pan Film
	KREC	Kodak Recording 2475
	KSAF1	Kodak Spectrum Analysis Film, No. 1
	KSAP1	Kodak Spectrum Analysis Plate, No. 1
	KSAP3	Kodak Spectrum Analysis Plate, No. 3
	KSWRP	Kodak Short Wave Radiation Plate
	KTMXCN	Kodak Professional T-MAX Black and White Film CN
	KTMX	Kodak Professional T-MAX
	KTMZ	Kodak Professional T-MAX P3200 Film
	KTP2415	Kodak Technical Pan Film 2415, ESTAR-AH Base
	KTPKTRP	Kodak Technical Pan Film TRI-Pan Professional
	KTRXPT	Kodak TRI-X Pan Professional 4164, ESTAR Thick Base
	KTRXP	Kodak TRI-Pan Professional

	KTXP	Kodak TRI-X Professional, Interior Tungsten
	KTXT	Kodak TRI-X Professional, Interior Tungsten
	KTX	Kodak TRI-X Professional
	KVCP	Kodak Verichrome Pan
Konica	CIFR	Kodak Infrared 750
Polaroid	PPGH	Konica Polagraph HC
	PPLB	Polaroid Polablue BN
	PPPN	Polaroid Polapan CT
Reserved	--	See Table 20

Table 24: Duplicating & Internegative Film

Company	Literal	Description
Agfa	ACRD	Agfa Agfachrome Duplication Film CRD
Fuji	FCDU	Fuji Fujichrome CDU Duplicating
	FCDU1	Fujichrome CDU Duplicating, Type I
	FCDU2	Fuji Fujichrome CDU Duplicating, Type II
	FITN	Fuji Fujicolor Internegative IT-N
Kodak	K1571	Kodak 1571 Internegative
	K2475RE	Kodak Recording Film 2475
	K4111	Kodak 4111
	KC4125	Kodak Professional Professional Copy Film 4125
	K6121	Kodak 6121
	KA2405	Kodak Double-X Aerographic Film 2405
	KA2422	Kodak Aerographic Direct Duplicating Film 2422
	KA2447	Kodak Aerochrome II Duplicating Film 2447
	KAR	Kodak Aerographic RA Duplicating Film 2425, ESTAR Base
	KARA4425	Kodak Aerographic RA Duplicating Film 4425, ESTAR Thick Base
	KARA	Kodak Aerographic RA Duplicating Film
	KCIN	Kodak Commercial Internegative Film
	KE5071	Kodak Ektachrome Slide Duplicating Film 5071
	KE5072	Kodak Ektachrome Slide Duplicating Film 5072
	KE6121	Kodak Ektachrome Slide Duplicating Film 6121
	KE7121K	Kodak Ektachrome Duplicating Film 7121, Type K
	KESO366	Kodak Ektachrome SE Duplicating Film SO -366
	KS0279	Kodak S0279
	KS0366	Kodak S0366
	KSO132	Kodak Professional B/W Duplicating Film SO-132
	KV4325	Kodak Vericolor Internegative 4325
	KVIN	Kodak Vericolor Internegative Film
Reserved	--	See Table 20

Table 24: Facsimile. Table 24 Facsimile lists supported file formats used in facsimile imaging. All digital formats are supported, plus G1-G5, for a total of 159 supported formats. Any number of facsimile media are permissible.

Table 25: Facsimile			
Category	Literal	Description	
Digital	--	See Table 27	
Facsimile	DFAXH	DigiBoard, DigiFAX Format, Hi-Res	
	DFAXL	DigiBoard, DigiFAX Format, Normal-Res	
	G1	Group 1 Facsimile	
	G2	Group 2 Facsimile	
	G3	Group 3 Facsimile	
	G32D	Group 3 Facsimile, 2D	
	G4	Group 4 Facsimile	
	G42D	Group 4 Facsimile, 2D	
	G5	Group 4 Facsimile	
	G52D	Group 4 Facsimile, 2D	
	TIFFG3	TIFF Group 3 Facsimile	
	TIFFG3C	TIFF Group 3 Facsimile, CCITT RLE 1D	
	TIFFG32D	TIFF Group 3 Facsimile, 2D	
	TIFFG4	TIFF Group 4 Facsimile	
	TIFFG42D	TIFF Group 4 Facsimile, 2D	
	TIFFG5	TIFF Group 5 Facsimile	
	TIFFG52D	TIFF Group 5 Facsimile, 2D	
Reserved	--	See Table 20	

Table 26: Prints. Table 26 Prints lists supported file formats used in print imaging, such as paper prints for display. 230 defaults are provided; any number of print media are permissible.

Table 26: Prints			
Company	Literal	Description	
Agfa	ACR	Agfacolor RC	
	ABF	Agfa Brovira, fiber, B&W	
	ABSRC	Agfa Brovira-speed RC, B&W	
	APF	Agfa Portriga, fiber, B&W	
	APSRC	Agfa Portriga-speed RC, B&W	
	ARRF	Agfa Record-rapid, fiber, B&W	
	ACHD	Agfacolor HDC	
	AMCC111FB	Agfacolor Multicontrast Classic MC C 111 FB, double weight, glossy surface	
	AMCC118FB	Agfacolor Multicontrast Classic MC C 118 FB, double weight, fine grained matt surface	
	AMCC1FB	Agfacolor Multicontrast Classic MC C 1FB, single weight, glossy surface	

1		AMCP310RC	Agfacolor Multicontrast Premium RC 310, glossy surface
2		AMCP312RC	Agfacolor Multicontrast Premium RC 312, semi-matt surface
3		APORG	Agfacolor Professional Portrait Paper, glossy surface CN310
4		APORL	Agfacolor Professional Portrait Paper, semi-matt surface
5			CN312
6		APORM	Agfacolor Professional Portrait Paper, lustre surface CN319
7		ASIGG	Agfacolor Professional Signum Paper, glossy surface CN310
8		ASIGM	Agfacolor Professional Signum Paper, matt surface CN312
9	Konica	CCOL	Konica Color
10	Fuji	FCHPFCPI	FujicolorFHGuProfessionaljicolor Print
11		FCSP	Fujicolor Super G Plus Print
12		FCT35	Fujichrome paper, Type 35, glossy surface
13		FCT35HG	Fujichrome reversal copy paper, Type 35, glossy surface
14		FCT35HL	Fujichrome reversal copy paper, Type 35, lustre surface
15		FCT35HM	Fujichrome reversal copy paper, Type 35, matt surface
16		FCT35L	Fujichrome paper, Type 35, lustre surface
17		FCT35M	Fujichrome paper, Type 35, matt surface
18		FCT35PG	Fujichrome Type535, polyester, super glossly surface
19		FSFA5G	Fujicolor paper super FA, Type 5, glossy SFA5 surface
20		FSFA5L	Fujicolor paper super FA, Type 5, lustre SFA5 surface
21		FSFA5M	Fujicolor paper super FA, Type 5, matt SFA5 surface
22		FSFASCG	Fujicolor paper super FA5, Type C, glossy surface
23		FSFA5SL	Fujicolor paper super FA5, Type C, lustre surface
24		FSFA5SM	Fujicolor paper super FA5, Type C, matt surface
25		FSFA5SPG	Fujicolor paper super FA, Type 5P, glossy SFA P surface
26		FSFA5SPL	Fujicolor paper super FA, Type 5P, lustre SFA P surface
27		FSFA5SPM	Fujicolor paper super FA, Type 5P, matt SFA P surface
28		FSFAG	Fujicolor paper super FA, Type 5, glossy surface
29		FSFAL	Fujicolor paper super FA, Type 5, lustre surface
30		FSFAM	Fujicolor paper super FA, Type 5, matt surface
31		FSFAS5PG	Fujicolor paper super FA, Type P, glossy SFA 5P surface
32		FSFAS5PL	Fujicolor paper super FA, Type P, lustre SFA 5P surface
33		FSFAS5PM	Fujicolor paper super FA, Type P, matt SFA 5P surface
34		FSFASCG	Fujicolor paper super FA, Type C, glossy surface
35		FSFASCL	Fujicolor paper super FA, Type C, lustre surface
36		FSFASCM	Fujicolor paper super FA, Type C, matt surface
37		FTRSFA	Fujitrans super FA
38		FXSFA	Fujiflex super FA polyester (super gloss), Fujiflex SFA
39			surface
40	Ilford	ICF1K	Ilfochrome Classic Deluxe Glossy Low Contrast
41		ICLM1K	Ilfochrome Classic Deluxe Glossy Medium Contrast
42		ICPM1M	Ilfochrome Classic RC Glossy
43		ICPM44M	Ilfochrome Classic RC Pearl
44		ICPS1K	Ilfochrome Classic Deluxe Glossy
45		IGFB	Ilfochrome Galerie FB
46		IILRA1K	Ilfocolor Deluxe
47		IIPRAM	Ilfocolor RC
48		IMG1FDW	Ilford Multigrade Fiber, Double Weight
49		IMG1FW	Ilford Multigrade Fiber Warmtone
50		IMG1RCDLX	Ilford Multigrade RC DLX

1	IMG1RCPDW	Ilford Multigrade RC Portfolio, Double Weight
2	IMG1RCR	Ilford Multigrade RC Rapid
3	IMG2FDW	Ilford Multigrade II Fiber, Double Weight
4	IMG2FW	Ilford Multigrade II Fiber Warmtone
5	IMG2RCDLX	Ilford Multigrade II RC
6	IMG1RCPDW	Ilford Multigrade II RC Portfolio, Double Weight
7	IMG2RCR	Ilford Multigrade II RC Rapid
8	IMG3FDW	Ilford Multigrade III Fiber, Double Weight
9	IMG3FW	Ilford Multigrade III Fiber Warmtone
10	IMG3RCDLX	Ilford Multigrade III RC DLX
11	IMG3RCPDW	Ilford Multigrade III RC Portfolio, Double Weight
12	IMG3RCR	Ilford Multigrade III RC Rapid
13	IMG4FDW	Ilford Multigrade IV Fiber, Double Weight
14	IMG4FW	Ilford Multigrade IV Fiber Warmtone
15	IMG4RCDLX	Ilford Multigrade IV RC DLX
16	IMG4RCPDW	Ilford Multigrade IV RC Portfolio, Double Weight
17	IMGFSWG	Ilford Multigrade Fiber, Single Weight, glossy
18	IPFP	Ilford PanF Plus
19	ISRCD	Ilfospeed RC, Deluxe
20	Kodak	B&W Selective Contrast Papers
21	KPC1RCE	Kodak Polycontrast RC, medium weight, fine-grained, lustre
22	KPC1RCF	Kodak Polycontrast RC, medium weight, smooth, glossy
23	KPC1RCN	Kodak Polycontrast RC, medium weight, smooth, semi-matt
24	KPC2RCE	Kodak Polycontrast II RC, medium weight, fine-grained, lustre
25	KPC2RCF	Kodak Polycontrast II RC, medium weight, smooth, glossy
26	KPC2RCN	Kodak Polycontrast II RC, medium weight, smooth, semi-matt
27	KPCRCE	Kodak Polycontrast III RC, medium weight, fine-grained, lustre
28		
29	KPC3RCF	Kodak Polycontrast III RC, medium weight, smooth, glossy
30	KPC3RCN	Kodak Polycontrast III RC, medium weight, smooth, semi-matt
31		
32	KPMFF	Kodak Polymax Fiber, single weight, smooth, glossy
33	KPMFN	Kodak Polymax Fiber, single weight, smooth, semi-matt
34	KPMFE	Kodak Polymax Fiber, single weight, fine-grained, lustre
35	KPM1RCF	Kodak Polymax RC, single weight, smooth, glossy
36	KPM1RCE	Kodak Polymax RC, single weight, fine-grained, lustre
37	KPM1RCN	Kodak Polymax RC, single weight, smooth, semi-matt
38	KPM2RCF	Kodak Polymax II RC, single weight, smooth, glossy
39	KPM2RCE	Kodak Polymax II RC, single weight, fine-grained, lustre
40	KPM2RCN	Kodak Polymax II RC, single weight, smooth, semi-matt
41	KPMFAF	Kodak Polymax Fine-Art, double weight, smooth, glossy
42	KPMFAN	Kodak Polymax Fine-Art, double weight, smooth, semi-matt
43	KPPFM	Kodak Polyprint RC, medium weight, smooth, glossy
44	KPPNM	Kodak Polyprint RC, medium weight, smooth, semi-matt
45	KPPFM	Kodak Polyprint RC, medium weight, fine-grained, lustre
46	KPFFS	Kodak Polyfiber, single weight, smooth, glossy
47	KPFND	Kodak Polyfiber, double weight, smooth, semi-matt
48	KPFGL	Kodak Polyfiber, light weight, smooth, lustre
49	KPFNS	Kodak Polyfiber, smooth, single weight, semi-matt
50	KPFND	Kodak Polyfiber, double weight, smooth, semi-matt

1	KPFGD	Kodak Polyfiber, double weight, fine-grained, lustre
2		
3		B&W Continuous Tone Papers
4	KAZOF	Kodak AZO, fine-grained, lustre
5	KB1RCF	Kodak Kodabrome RC Paper, smooth, glossy
6	KB1RCG1	Kodak Kodabrome RC, premium weight (extra heavy)
7		1, fine-grained, lustre
8	KB1RCN	Kodak Kodabrome RC Paper, smooth, semi-matt
9	KB2RCF	Kodak Kodabrome II RC Paper, smooth, glossy
10	KB2RCG1	Kodak Kodabrome II RC, premium weight (extra
11		heavy) 1, fine-grained, lustre
12	KB2RCN	Kodak Kodabrome II RC Paper, smooth, semi-matt
13	KBR	Kodak Kodabromide, single weight, smooth, glossy
14	KEKLG	Kodak Ektalure, double weight, fine-grained, lustre
15	KEKMSCF	Kodak Ektamatic SC single weight, smooth, glossy
16	KEKMSCN	Kodak Ektamatic SC, single weight, smooth,
17		semi-matt
18	KEKMXRALF	Kodak Ektamax RA Professional L, smooth, glossy
19	KEKMXRALN	Kodak Ektamax RA Professional L, smooth,
20		semi-matt
21	KEKMXRAMF	Kodak Ektamax RA Professional M, smooth, glossy
22	KEKMXRAMN	Kodak Ektamax RA Professional M, smooth, smooth,
23		semi-matt
24	KELFA1	Kodak Elite Fine-Art, premium weight (extra heavy)
25		1, ultra-smooth, high-lustre
26	KELFA2	Kodak Elite Fine-Art, premium weight (extra heavy) 2,
27		ultra-smooth, high-lustre
28	KELFA3	Kodak Elite Fine-Art, premium weight (extra heavy) 3,
29		ultra-smooth, high-lustre
30	KELFA4	Kodak Elite Fine-Art, premium weight (extra heavy) 4,
31		ultra-smooth, high-lustre
32	KK1RCG1	Kodak Kodabrome RC, premium weight (extra heavy)
33		1, fine-grained, lustre
34	KK1RCG2	Kodak Kodabrome RC, premium weight (extra heavy)
35		2, fine-grained, lustre
36	KK1RCG3	Kodak Kodabrome RC, premium weight (extra heavy)
37		3, fine-grained, lustre
38	KK1RCG4	Kodak Kodabrome RC, premium weight (extra heavy)
39		4, fine-grained, lustre
40	KK1RCG5	Kodak Kodabrome RC, premium weight (extra heavy)
41		5, fine-grained, lustre
42	KK2RCG1	Kodak Kodabrome II RC, premium weight (extra
43		heavy) 1, fine-grained, lustre
44	KK2RCG2	Kodak Kodabrome II RC, premium weight (extra
45		heavy) 2, fine-grained, lustre
46	KK2RCG3	Kodak Kodabrome II RC, premium weight (extra
47		heavy) 3, fine-grained, lustre
48	KK2RCG4	Kodak Kodabrome II RC, premium weight (extra
49		heavy) 4, fine-grained, lustre
50	KK2RCG5	Kodak Kodabrome II RC, premium weight (extra

1		heavy) 5, fine-grained, lustre
2	KPMARCW1	Kodak P-Max Art RC, double weight 1, suede
3		double-matt
4	KPMARCW2	Kodak P-Max Art RC, double weight 2, suede
5		double-matt
6	KPMARCW3	Kodak P-Max Art RC, double weight 3, suede
7		double-matt
8		
9		B&W Panchromatic Papers
10	KPSRCH	Kodak Panalure Select RC, H grade, medium weight,
11		smooth, glossy
12	KPSRCL	Kodak Panalure Select RC, L grade, medium weight,
13		smooth, glossy
14	KPSRCM	Kodak Panalure Select RC, M grade, medium weight,
15		smooth, glossy
16		
17		Color Reversal Papers
18	KER1F	Kodak Ektachrome Radiance Paper, smooth, glossy
19	KER1N	Kodak Ektachrome Radiance Paper, smooth,
20		semi-matt
21	KER1SF	Kodak Ektachrome Radiance Select Material, smooth,
22		glossy
23	KER2F	Kodak Ektachrome Radiance II Paper, smooth, glossy
24	KER2N	Kodak Ektachrome Radiance II Paper, smooth,
25		semi-matt
26	KER2SF	Kodak Ektachrome Radiance II Select Material,
27		smooth, glossy
28	KER3F	Kodak Ektachrome Radiance III Paper, smooth, glossy
29	KER3N	Kodak Ektachrome Radiance III Paper, smooth,
30		semi-matt
31	KER3SF	Kodak Ektachrome Radiance III Select Material,
32		smooth, glossy
33	KERCHCF	Kodak Ektachrome Radiance HC Copy Paper,
34		smooth, glossy
35	KERCHCN	Kodak Ektachrome Radiance HC Copy Paper,
36		smooth, semi-matt
37	KERCN	Kodak Ektachrome Radiance Copy Paper, smooth,
38		semi-matt
39	KERCTF	Kodak Ektachrome Radiance Thin Copy Paper,
40		smooth, glossy
41	KERCTN	Kodak Ektachrome Radiance Thin Copy Paper,
42		smooth, semi-matt
43	KEROM	Kodak Ektachrome Radiance Overhead Material,
44		transparent ESTAR Thick Base
45		
46		Color Negative Papers & Transparency Materials
47	KD2976E	Kodak Digital Paper, Type 2976, fine-grained, lustre
48	KD2976F	Kodak Digital Paper, Type 2976, smooth, glossy
49	KD2976N	Kodak Digital Paper, Type 2976, smooth, semi-matt
50	KDCRA	Kodak Duraclear RA Display Material, clear

1	KDFRAF	Kodak Duraflex RA Print Material, smooth, glossy
2	KDT2	Kodak Duratrans Display Material, translucent
3	KDTRA	Kodak Duratrans RA Display Material, translucent
4	KECC	Kodak Ektacolor, Type C
5	KECE	Kodak Ektacolor Professional Paper, fine-grained,
6		lustre
7	KECF	Kodak Ektacolor Professional Paper, smooth, glossy
8	KECN	Kodak Ektacolor Professional Paper, smooth,
9		semi-matt
10	KEC	Kodak Ektacolor
11	KEP2E	Kodak Ektacolor Portra II Paper, Type 2839,
12		fine-grained, lustre
13	KEP2F	Kodak Ektacolor Portra II Paper, Type 2839, smooth,
14		glossy
15	KEP2N	Kodak Ektacolor Portra II Paper, Type 2839, smooth,
16		semi-matt
17	KEP3E	Kodak Ektacolor Portra III Paper, fine-grained, lustre
18	KEP3F	Kodak Ektacolor Portra III Paper, smooth, glossy
19	KEP3N	Kodak Ektacolor Portra III Paper, smooth, semi-matt
20	KES2E	Kodak Ektacolor Supra II Paper, fine-grained, lustre
21	KES2F	Kodak Ektacolor Supra II Paper, smooth, glossy
22	KES2N	Kodak Ektacolor Supra II Paper, smooth, semi-matt
23	KES3E	Kodak Ektacolor Supra III Paper, fine-grained, lustre
24	KES3F	Kodak Ektacolor Supra III Paper, smooth, glossy
25	KES3N	Kodak Ektacolor Supra III Paper, smooth, semi-matt
26	KESE	Kodak Ektacolor Supra Paper, fine-grained, lustre
27	KESF	Kodak Ektacolor Supra Paper, smooth, glossy
28	KESN	Kodak Ektacolor Supra Paper, smooth, semi-matt
29	KET1	Kodak Ektatrans RA Display Material, smooth,
30		semi-matt
31	KEU2E	Kodak Ektacolor Ultra II Paper, fine-grained, lustre
32	KEU2F	Kodak Ektacolor Ultra II Paper, smooth, glossy
33	KEU2N	Kodak Ektacolor Ultra II Paper, smooth, semi-matt
34	KEU3E	Kodak Ektacolor Ultra III Paper, fine-grained, lustre
35	KEU3F	Kodak Ektacolor Ultra III Paper, smooth, glossy
36	KEU3N	Kodak Ektacolor Ultra III Paper, smooth, semi-matt
37	KEUE	Kodak Ektacolor Ultra Paper, fine-grained, lustre
38	KEUF	Kodak Ektacolor Ultra Paper, smooth, glossy
39	KEUN	Kodak Ektacolor Ultra Paper, smooth, semi-matt
40		
41		Inkjet Papers & Films
42	KEJFC50HG	Kodak Ektajet 50 Clear Film LW4, Polyester Base,
43		clear
44	KEJFLFSG	Kodak Ektajet Film, Type LF, semi-gloss
45	KEJFW50HG	Kodak Ektajet 50 White Film, Polyester Base, high
46		gloss
47	KEJP50SG	Kodak Ektajet 50 Paper, RC Base, semi-gloss
48	KEJPC	Kodak Ektajet Coated Paper
49	KEJPCHW	Kodak Ektajet Heavy Weight Coated Paper
50	KEJPEFSG	Kodak Ektajet Paper, Type EF, semi-gloss

1		KEJPLFSG	Kodak Ektajet Paper, Type LF, semi-gloss
2	Polaroid	POCP	Polaroid OneFilm Color Print
3		PPCP	Polaroid Professional High Contrast Polychrome
4		PPGH	Polaroid Polygraph HC
5		PPLB	Polaroid Polablue BN
6		PPPN	Polapan CT
7	Reserved	--	See Table 20
8			
9			

10 **Table 26: Digital Formats.** Table 26 Digital lists supported
 11 file
 12 formats used in digital imaging. 159 default values are
 13 provided
 14 in the preferred embodiment although any number of digital
 15 media
 16 are permissible.

Table 27: Digital

20	Category	Literal	Description
21	<hr/>		
22	Digital	ACAD	AutoCAD database or slide
23		ASCI	ASCII graphics
24		ATK	Andrew Toolkit raster object
25		AVI	Microsoft video
26		AVS	AVS X image
27		BIO	Biorad confocal file
28		BMP	Microsoft Windows bitmap image
29		BMPM	Microsoft Windows bitmap image, monochrome
30		BPGM	Bentleyized Portable Graymap Format
31		BRUS	Doodle brush file
32		CGM	CGM
33		CDR	Corel Draw
34		CIF	CIF file format for VLSI
35		CGOG	Compressed GraphOn graphics
36		CMUW	CMU window manager bitmap
37		CMX	Corel Vector
38		CMYK	Raw cyan, magenta, yellow, and black bytes
39		CQT	Cinepak Quicktime
40		DVI	Typesetter DeVice Independent format
41		EPS	Adobe Encapsulated PostScript
42		EPSF	Adobe Encapsulated PostScript file format
43		EPSI	Adobe Encapsulated PostScript Interchange format

1	FIG	Xfig image format
2	FIT	Flexible Image Transport System
3	FLC	FLC movie file
4	FLI	FLI movie file
5	FST	Usenix FaceSaver(tm) file
6	G10X	Gemini 10X printer graphics
7	GEM	GEM image file
8	GIF	CompuServe Graphics image
9	GIF8	CompuServe Graphics image (version 87a)
10	GOUL	Gould scanner file
11	GRA	Raw gray bytes
12	HDF	Hierarchical Data Format
13	HIPS	HIPSfile
14	HIS	Image Histogram
15	HPLJ	Hewlett Packard LaserJet format
16	HPPJ	Hewlett Packard PaintJet
17	HTM	Hypertext Markup Language
18	HTM2	Hypertext Markup Language, level 2
19	HTM3	Hypertext Markup Language, level 3
20	HTM4	Hypertext Markup Language, level 4
21	ICON	Sun icon
22	ICR	NCSA Telnet Interactive Color Raster graphic format
23	IFF	Electronic Arts
24	ILBM	Amiga ILBM file
25	IMG	Img-whatnot file
26	JBG	Joint Bi-level image experts Group file interchange format
27	JPG	Joint Photographic experts Group file interchange format
28	LISP	Lisp machine bitmap file
29	MACP	Apple MacPaint file
30	MAP	Colormap intensities and indices
31	MAT	Raw matt bytes
32	MCI	MCI format
33	MGR	MGR bitmap
34	MID	MID format
35	MIF	ImageMagick format
36	MTS	Mitsubishi S340-10 Color sublimation
37	MMM	MMM movie file
38	MOV	Movie format
39	MP2	Motion Picture Experts Group (MPEG) interchange format, level
40		2
41	MP3	Motion Picture Experts Group (MPEG) interchange format, level
42		3
43	MPG	Motion Picture Experts Group (MPEG) interchange format, level
44		1
45	MSP	Microsoft Paint
46	MTV	MTV ray tracer image
47	NKN	Nikon format
48	NUL	NULL image
49	PBM	Portable BitMap
50	PCD	Kodak Photo-CD

1	PCX	Zsoft IBM PC Paintbrush
2	PDF	Portable Document Format table
3	PGM	Portable GrayMap format
4	PGN	Portable GrayMap format
5	PI1	Atari Degas .pi1 Format
6	PI3	Atari Degas .pi3 Format
7	PIC	Apple Macintosh QuickDraw/PICT
8	PLOT	Unix Plot(5) format
9	PNG	Portable Network Graphics
10	PNM	Portable anymap
11	PPM	Portable pixmap
12	PPT	Powerpoint
13	PRT	PRT ray tracer image
14	PS1	Adobe PostScript, level 1
15	PS2	Adobe PostScript, level 2
16	PSD	Adobe Photoshop
17	QRT	QRT ray tracer
18	RAD	Radiance image
19	RAS	CMU raster image format
20	RGB	Raw red, green, and blue bytes
21	RGBA	Raw red, green, blue, and matt bytes
22	RLE	Utah Run length encoded image
23	SGI	Silicon Graphics
24	SIR	Solitaire file format
25	SIXL	DEC sixel color format
26	SLD	AutoCADA slide filea
27	SPC	Atari compressed Spectrum file
28	SPOT	SPOT satellite images
29	SUN	SUN Rasterfile
30	TGA	Targa True Vision
31	TIF	Tagged Image Format
32	TIL	Tile image with a texture
33	TXT	Raw text
34	UIL	Motif UIL icon file
35	UPC	Universal Product Code bitmap
36	UYVY	YUV bit/pixel interleaved (AccomWSD)
37	VIC	Video Image Communication and Retrieval (VICAR)
38	VID	Visual Image Directory
39	VIF	Khoros Visualization image
40	WRL	Virtual reality modeling language
41	X1BM	X10 bitmap
42	XBM	X11 bitmap
43	XCC	Constant image of X server color
44	XIM	XIM file
45	XPM	X11 pixmap
46	XWD	X Window system window Dump
47	XXX	Image from X server screen
48	YBM	Bennet Yee ``face" file
49	YUV	Abekas Y- and U- and Y-file
50	YUV3	Abekas Y- and U- and Y-file, 3

1		ZEIS	Zeiss confocal file
2		ZINC	Zinc bitmap
3	Facsimile	--	See Table 25
4	Reserved	--	See Table 20
5			

6 Conclusion

7 This invention supports an indefinite number of formal
8 objects. At the current time, supported objects are parent-
9 child encoding, 1D and 2D barcoding, and a reasonably sized
10 schemata. The invention's means of classification and archive
11 notation is sufficiently flexible to be used in a variety of
12 imaging situations shown. The examples given are meant to
13 provide illustrations only and not to be limiting with respect
14 to the types of imaging situations to which the present
15 invention might apply.

16 The rules and notations specified in the preceding tables
17 provide a basis for universal image enumeration encoding,
18 decoding, and processing suitable for development of diverse
19 implementations of the invention.

20 ASIA

21 The present invention is implemented in a variety of hardware
22 embodiments. Common to these embodiments is the ability of the
23 equipment to process information(i.e. a CPU of some type is
24 required, a means for entering data satisfying the require
25 syntax is necessary (i.e. some form of user data entry in the
26 form of a keyboard, optical reader, voice entry, point-and-
27 click, or other data entry means), a built-in encoding
28 mechanism or some form of data storage means to hold, at least

1 temporarily the data input by the user, a data recording means
2 in order to process the information and output a barcode or
3 other graphical representation of data.

4 Processing flow

5 Referring to Figure 7 the processing flow of ASIA is shown.

6 Command 701 is a function call that accesses the
7 processing to be performed by ASIA

8 Input format 703 is the data format arriving to ASIA. For
9 example, data formats from Nikon, Hewlett Packard, Xerox,
10 Kodak, etc., are input formats.

11 ILF (705, 707, and 709) are the Input Language Filter
12 libraries that process input formats into ASIA-specific format,
13 for further processing. For example, an ILF might convert a
14 Nikon file format into an ASIA processing format. ASIA
15 supports an unlimited number of ILFs.

16 Configuration 711 applies configuration to ILF results.
17 Configuration represents specifications for an application,
18 such as length parameters, syntax specifications, names of
19 component tables, etc.

20 CPF (713, 715, and 717) are Configuration Processing
21 Filters which are libraries that specify finite bounds for
22 processing, such pre-processing instructions applicable to
23 implementations of specific devices. ASIA supports an
24 unlimited number of CPFs. Processing 719 computes output,
25 such as data converted into numbers.

26 Output format 721 is a structured output used to return

1 processing results.

2 OLF (723, 725, 727) are Output Language Filters which are
3 libraries that produce formatted output, such as barcode
4 symbols, DBF, Excel, HTML, L^ATEX, tab delimited text,
5 WordPerfect, etc. ASIA supports an unlimited number of OLFs.

6 Output format driver 729 produces and/or delivers data to
7 an Output Format Filter. OFF (731, 733, 735) are Output Format
8 Filters which are libraries that organize content and
9 presentation of output, such as outputting camera shooting
10 data, database key numbers, data and database key numbers, data
11 dumps, device supported options, decoded number values, etc.
12 ASIA supports an unlimited number of OLFs.

13 **Numeric ranges**

14 ASIA uses indefinite numeric ranges for all of its variables
15 except date, which supports years 0000-9999. ASIA provides
16 default values for the numeric ranges, which represent a
17 preferred embodiment, and are not meant to be limiting. Indeed
18 the present invention can accommodate additional values
19 depending upon the implementation selected. And the current
20 ranges and values can be easily extended, depending upon the
21 needs of specific implementation.

22 **Location numbers.** Location numbers track any number of
23 generation, any number of lots, and date to the day.
24 Optionally, location numbers track time to any granularity of
25 accuracy, any number of concurrent authors, any number of
26 devices, any number of images in an archive, any number of

1 additional data for future extensibility, and any number of
2 additional data for user customization.

3 **Image numbers.** Image numbers track any number of imaging
4 categories (2 defaults), any number of media sizes (47
5 defaults); any number of push settings or any number of dynamic
6 range ("bit depth") settings, keyed by format; any number of
7 transparency media types (60 defaults), any number of negative
8 media types (115 defaults), any number of print media types
9 (209 defaults), any number of packages (90 defaults), and any
10 number of digital formats (159 defaults); any unit of
11 resolution; any number of stain (presentation) forms (9
12 defaults); and any number of image formats (12 defaults).
13 Finally, image numbers optionally support any number of
14 additional data for future extensibility, and any number of
15 additional data for user customization.

16 **Parent numbers.** Parent numbers track parent conception date.
17 Since an archive can have any number of images, an archive also
18 contains any number of parents. Parent numbers optionally
19 support any unit of additional data for future extensibility,
20 and any unit of additional data for user customization.

21 All variables use unbounded value ranges except for the
22 variable date, which supports years 0000-9999. Table 8
23 **Variables with unbounded ranges** specifically identifies
24 unbounded variables, organized by type of number (**Number**),
25 category of functionality (**Category**), and corresponding
26 variable (**Variable**).

1 Syntactic rules guarantee consistency across all
 2 implementations; see **Syntax: Tables 10-11** above. No matter how
 3 differently implementations are customized, all implementations
 4 that are compliant with the encoding scheme described herein
 5 will exchange data.

6	<u>Number</u>	<u>Category</u>	<u>Variable</u>
7	location	number of generations	<i>generation</i>
8	location	number of lots in an archive	<i>sequence</i>
9	location	number of units in a lot	<i>unit</i>
10	location	number of authors	<i>author</i>
11	location	number of devices	<i>device</i>
12	location	granularity of time accuracy	<i>time</i>
13	location	specification extensibility	<i>locationRes</i>
14	location	user customization	<i>locationCus</i>
15	image	number of categories	<i>category</i>
16	image	number of media	<i>media</i>
17	image	number of software packages	<i>set</i>
18	image	number of stains	<i>stain</i>
19	image	number of formats	<i>format</i>
20	image	range of push settings	<i>push</i>
21	image	range of bit depth	<i>bit</i>
22	image	range of size	<i>size</i>
23	image	range of resolution	<i>resolution</i>
24	image	specification extensibility	<i>imageRes</i>
25	image	user customization	<i>imageCus</i>
26	parent	granularity of time accuracy	<i>parent</i>
27	parent	specification extensibility	<i>parentRes</i>
28	parent	user customization	<i>parentCus</i>

29 Table 8: Variables with unbounded ranges

30 **Examples.** More specifically, 4 examples will illustrate
 31 ASIA's interoperability. All of these examples use a 4
 32 digit sequence definition (i.e., supporting 9,999 lots),
 33 but each example adjusts the unit definition and employs
 34 the optional variables *device* and/or *author*. Values of
 35 *device* and *author* are adjusted irregularly across the
 36 examples.

37 **Example.** Using 36 unit lots, useful for traditional 35mm

1 photography, this creates an upper bound of 359,964 images
2 per archive (or 7,199 images a year for 50 years). 1
3 digit device encoding⁷ is used supporting up to 10
4 concurrently used devices.

5 **Example.** Using 99 unit lots, useful for digital imaging,
6 this creates an upper bound of 989,901 images per archive
7 (or 19,798 images a year for 50 years). 2 digit device
8 encoding is used supporting up to 100 concurrently used
9 devices.

10 **Example.** Using 9,999 unit lots, useful for photocopy
11 imaging, this creates an upper bound of 100 million
12 (99,980,001) images per archive (or 2 million [1,999,600]
13 images a year for 50 years). 3 character author encoding
14 is used supporting up to 676 concurrent authors in the
15 archive, device is unspecified.

16 **Example.** Using 999,999 unit lots, suitable for motion
17 imaging, this creates an upper bound of 9,998,990,001 (10
18 trillion) images per archive (or 200 million [199,979,800]
19 images a year for 50 years). 4 character author
20 encoding is used supporting up to 456,976 concurrent
21 authors; and 3 digit device encoding is used supporting up
22 to 1000 concurrently used devices per author.

23 Data from all of the above example can be seamlessly
24 shared using the encoding scheme of the present invention.

25 **Parent-child Processing**

26 **Implementation.** ASIA provides native support of parent

1 decoding and is written to support parent encoding. However,
2 since parent-child encoding functionality must operate directly
3 with resolvers (see Figure 3) multi-generation encoding is left
4 to device specific implementations.

5 ASIA implements parent-child support through the
6 'schemata' and 'engine' components of the Figure 5
7 **Implementation** through extensive use of OLF's (See Figure 7
8 ASIA).

9 **Barcode Processing**

10 **Implementation.** ASIA natively supports 1D Code 39 and 2D Data
11 Matrix barcodes. ASIA implements barcoding through the
12 'engine' component of the implementation.

13 **Code Instantiation**

14 The ASIA engine library specifically implements the
15 invention's formal requirements for classification and archival
16 notation and in this sense provides a reference implementation
17 of the invention's relations.

18 ASIA is written in ANSI C++, with flexibility and
19 performance improving extensions for Win32 and SVID compliant
20 UNIXes. It has been developed to work as a library for
21 inclusion into other software, or as a core engine to which
22 interfaces are written. ASIA is modularized into small,
23 convenient encoding and decoding filters (libraries): ILFs,
24 CPFs, OLFs, and OFFs. To create a full implementation, a
25 developer often needs only to write 1 filter of each variety.
26 These filters are simple, sometimes a few lines of code each.

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Such extensibility is designed to permit rapid porting of ASIA to diverse applications. For example, with minimal effort, a programmer may port ASIA to a new device or software package. With little or no customization, the ASIA engine library may plug into pre-existing applications, serve as a back-end for newly written interfaces, or be included directly into chips with tabular information maintained through Flash ROM upgrades, etc. ASIA illustrates all 3 layers of the invention, as characterized in Figure 1. Specifically, ASIA provides a robust set of native functionality in a core code offering. The core code has been developed for extreme, rapid, and convenient extensibility. ASIA's extensibility provides theoretically unlimited interoperability with devices, mechanisms, and software, while requiring absolutely minimal development effort and time.

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It is expected that ASIA subsumes the functionality needed by most applications for which the Automated System for Image Archiving applies, but ASIA itself merely is one implementation of the invention's formal specifications presented in §4.2.

21

Utility

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For the author, devices that implement this invention can provide a convenient, accurate, and flexible tracking system that builds cumulatively and automatically into a comprehensive, rationally organized archival system that required no archival knowledge whatsoever to use. This can

1 reduce many administrative needs facing those who use image-
2 producing devices. Similarly, after a user initializes the
3 systems, the system will work without user intervention.

4 For example, the need for photographic assistants could be
5 curtailed in professional photography. Using a device
6 constructs an archive without human intervention, and clicking
7 a barcode reader on an image displays image data.

8 For the archivist, mechanisms implementing this invention
9 can automate exact and rapid tacking of every image in a given
10 archive, for inventory/sales, author identification, historical
11 record, etc. For example, an advertising agency could recall
12 client information and image production facts from a click of a
13 barcode reader. A newspaper could process, identify, and track
14 images from its photographic staff through automated slide
15 sorting machines. Museums could automate collection and
16 inventory services as a matter of course in receiving new
17 materials.

18 For the manufacturer, implementations of this invention
19 can provide devices with automated encoding, decoding, and
20 processing systems, included in chips or accompanying software.
21 A device can produce self-identifying enumeration which
22 interoperates with other devices by the same manufacturer, or
23 with other devices from other manufacturers.

24 For example, a manufacturer could provide consumers with a
25 seamless mechanism to track image evolutions, from film
26 developing to digital editing to paper production. Or

1 hospitals could automatically track patient x-rays and MRI
2 scans as a matter of course in using the equipment. The
3 equipment could be manufactured by one or different
4 manufacturers, and the system would work seamlessly for the
5 end-user.
6

1 I Claim:

2 1. A system for universal image tracking comprising:

3 An image forming apparatus;

4 A CPU integral to the image forming apparatus;

5 User input means connected to the CPU for receiving user
6 input;

7 Logic stored in the CPU for receiving user input and
8 creating archive data based upon the user input; and

9 A Graphic code producer responsive to the CPU for
10 producing graphic codes representative of the archive
11 data.

12 2. The system for universal image tracking of claim 1 wherein
13 the image forming apparatus is a film based camera.

14 3. The system for universal image tracking of claim 1 wherein
15 the image forming apparatus is a digital based camera.

16 4. The system for universal image tracking of claim 1 wherein
17 the image forming apparatus is a video camera.

18 5. The system for universal image tracking of claim 1 wherein
19 the image forming apparatus is a digital image processor.

20 6. The system for universal image tracking of claim 1 wherein
21 the image forming apparatus is a medical image sensor.

22 7. The system for universal image tracking of claim 6 wherein
23 the medical image sensor is a magnetic resonance imager.

24 8. The system for universal image tracking of claim 6 wherein
25 the medical image sensor is an X-ray imager.

26 9. The system for universal image tracking of claim 6 wherein

1 the medical image sensor is a CAT scan imager.

2 10. The system for universal image tracking of claim 1 wherein
3 the user input means is a push button input.

4 11. The system for universal image tracking of claim 1 wherein
5 the user input means is a keyboard.

6 12. The system for universal image tracking of claim 1 wherein
7 the user input means is voice recognition equipment.

8 13. The system for universal image tracking of claim 1 wherein
9 the graphic codes are one-dimensional.

10 14. The system for universal image tracking of claim 1 wherein
11 the graphic codes are two-dimensional.

12 15. The system for universal image tracking of claim 1 wherein
13 the graphic codes are three-dimensional.

14 16. The system for universal image tracking of claim 1 wherein
15 the logic comprises configuration input processing for
16 determining bounds for the archive data generation based
17 on configuration input;
18 a resolver for determining the correct value of archive
19 data representing the image forming apparatus and the
20 configuration input; and
21 a timer for creating date/time stamps.

22 17. The system for universal image tracking of claim 16
23 wherein the timer further comprises a filter for
24 processing the time stamp according to configuration input
25 rules.

26 18. The system for universal image tracking of claim 16

1 wherein the configuration input comprises at least
2 generation, sequence, data, unit, and constants
3 information.

4 19. The system for universal image tracking of claim 1 further
5 comprising a graphic code reader connected to the CPU for
6 reading a graphic code on an image representing archive
7 information; and

8 A decoder for decoding the archive information represented
9 by the graphic code.

10 20. The system for universal image tracking of claim 19
11 wherein the logic further comprises:
12 logic for receiving a second user input and creating
13 lineage archive information relating to the image based
14 upon the archive information and the second user input;
15 and
16 logic for producing graphic code representative of the
17 lineage archive data.

18 21. The system for universal image tracking of claim 1 wherein
19 the archive data comprises location attributes of an
20 image.

21 22. The system for universal image tracking of claim 1 wherein
22 the archive data comprises physical attribute of an image.

23 23. The system for universal image tracking of claim 1 wherein
24 each image in an image archive has unique archive data
25 associated with each image.

26 24. The system for universal image tracking of claim 21

1 wherein the location data comprises at least:

2 image generation depth;

3 serial sequence of lot within an archive;

4 serial sequence of unit within a lot;

5 date location of a lot within an archive;

6 date location of an image within an archive;

7 author of the image; and

8 device producing the image.

9 25. The system for universal image tracking of claim 16

10 wherein the timer tracks year in the range of from 0000 to

11 9999.

12 26. The system for universal image tracking of claim 16

13 wherein the timer tracks all 12 months of the year.

14 27. The system for universal image tracking of claim 16

15 wherein the timer tracks time in at least hours and

16 minutes.

17 28. The system for universal image tracking of claim 16

18 wherein the timer tracks time in fractions of a second.

19 29. The system for universal image tracking of claim 16

20 wherein the system is ISO 8601:1988 compliant.

21 30. The system for universal image tracking of claim 22

22 wherein the physical attributes comprise at least:

23 image category;

24 image size;

25 push status;

26 digital dynamic range;

1 image medium;
2 image resolution;
3 image stain; and
4 image format.

5 31. The system for universal image tracking of claim 20
6 wherein the lineage archive information comprises a parent
7 number.

8 32. The system for universal image tracking of claim 31
9 wherein the parent number comprises at least:
10 a parent conception date; and
11 a parent conception time.

12 33. A method for universally tracking images comprising:
13 inputting raw image data to an image forming apparatus;
14 inputting image-related data; creating first archive data
15 based upon the image-related data; and translating the
16 first archive data into a form that can be attached to the
17 raw image data.

18 34. The method for universally tracking images of claim 33
19 wherein the raw image data is from a film based camera.

20 35. The method for universally tracking images of claim 33
21 wherein the raw image data is from a digital camera.

22 36. The method for universally tracking images of claim 33
23 wherein the raw image data is from a video camera.

24 37. The method for universally tracking images of claim 33
25 wherein the raw image data is from a digital image
26 processor.

- 1 38. The method for universally tracking images of claim 33
2 wherein the raw image data is from a medical image sensor.
- 3 39. The method for universally tracking images of claim 38
4 wherein the medical image sensor is a magnetic resonance
5 imager.
- 6 40. The method for universally tracking images of claim 38
7 wherein the raw image data is from an X-ray imager.
- 8 41. The method for universally tracking images of claim 38
9 wherein the raw image data is from a CAT scan imager.
- 10 42. The method for universally tracking images of claim 33
11 wherein the inputting image related data occurs without
12 user intervention.
- 13 43. The method for universally tracking images of claim 33
14 wherein the inputting of image related data occurs via
15 push button input.
- 16 44. The method for universally tracking images of claim 33
17 wherein the inputting of image related data occurs via
18 voice recognition equipment.
- 19 45. The method for universally tracking images of claim 33
20 wherein the inputting of image related data occurs via a
21 keyboard.
- 22 46. The method for universally tracking images of claim 33
23 wherein the form of the translated archive data is an
24 electronic file.
- 25 47. The method for universally tracking images of claim 33
26 wherein the form of the translated data is a graphic code.

48. The method for universally tracking images of claim 47 wherein the graphic code is one dimensional.
49. The method for universally tracking images of claim 47 wherein the graphic code is two dimensional.
50. The method for universally tracking images of claim 47 wherein the graphic code is three dimensional.
51. The method for universally tracking images of claim 33 wherein the image data comprises image data and second archive data.
52. The method for universally tracking images of claim 33 further comprising reading the second archive data; and creating lineage archive information relating to the image based upon the first archive information and second archive information.
53. The method for universally tracking images of claim 33 wherein the inputting of image related data comprises configuration input processing for determining bounds for the archive data generation based upon configured input; determining the correct value of archive data representing the image forming apparatus and configuration input; and date/time stamping the image related data.
54. The method for universally tracking images of claim 53 wherein date/time stamping is filtered according to configuration input rules.
55. The method for universally tracking images of claim 33 wherein the configuration input comprises at least

1 generation, sequence, data, unit, and constants
2 information.

3 56. The method for universally tracking images of claim 33
4 wherein the first archive data comprises location
5 attributes of an image.

6 57. The method for universally tracking images of claim 33
7 wherein the first archive data comprises physical
8 attributes of an image.

9 58. The method for universally tracking images of claim 56
10 wherein the location attributes comprise at least:
11 image generation depth;
12 serial sequence of lot within an archive;
13 serial sequence of unit within a lot;
14 date location of a lot within an archive;
15 date location of an image within an archive;
16 author of the image; and
17 device producing the image.

18 59. The method for universally tracking images of claim 57
19 wherein the physical attributes of an image comprise at
20 least:
21 image category;
22 image size;
23 push status;
24 digital dynamic range;
25 image medium;
26 software set;

- 1 image resolution;
2 image stain; and
3 image format.
- 4 60. The method for universally tracking images of claim 52
5 wherein the lineage archive information comprises a parent
6 number.
- 7 61. The method for universally tracking images of claim 52
8 wherein the parent number comprises at least:
9 a parent conception date; and
10 a parent conception time.
- 11 62. The system for universal image tracking of claim 1 wherein
12 the input means comprises a magnetic card reader.
- 13 63. The system for universal image tracking of claim 1 wherein
14 the input means comprises a laser scanner.
- 15 64. The system for universal image tracking of claim 31
16 wherein the physical attributes further comprise;
17 imageRes; and
18 imageCus.
- 19 65. The method for universally tracking images of claim 33
20 wherein the inputting image related data is via a magnetic
21 card reader.
- 22 66. The method for universally tracking images of claim 33
23 wherein the inputting of image related data is via a laser
24 scanner.
- 25 67. The method of universally tracking images of claim 33
26 wherein the inputting of image related data is via an

1 optical reader.

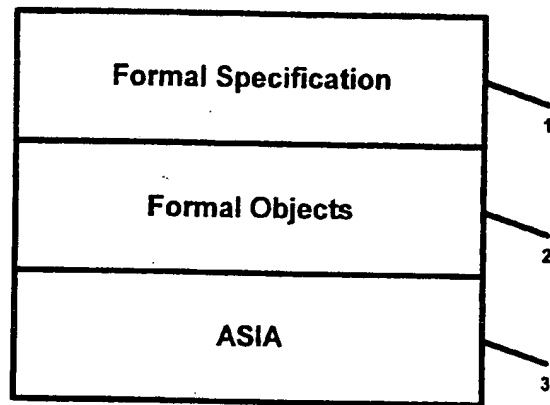


Figure 1

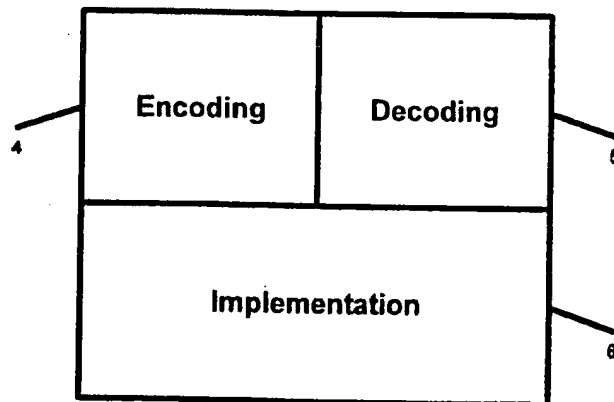


Figure 2

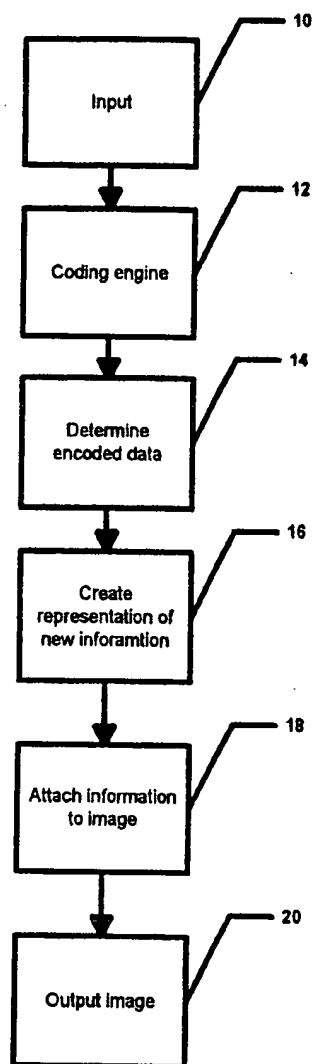


Figure 1A

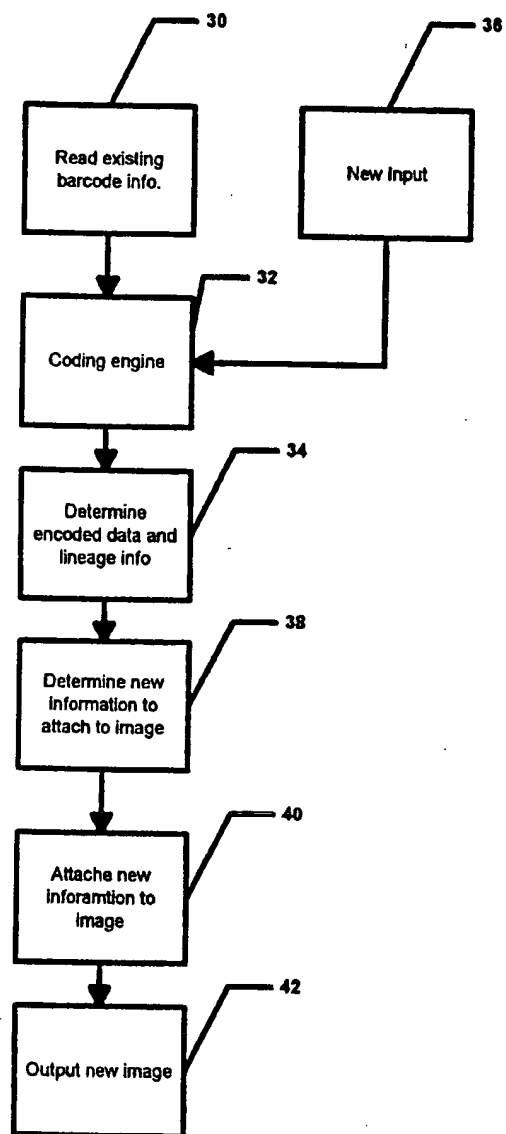


Figure 1B

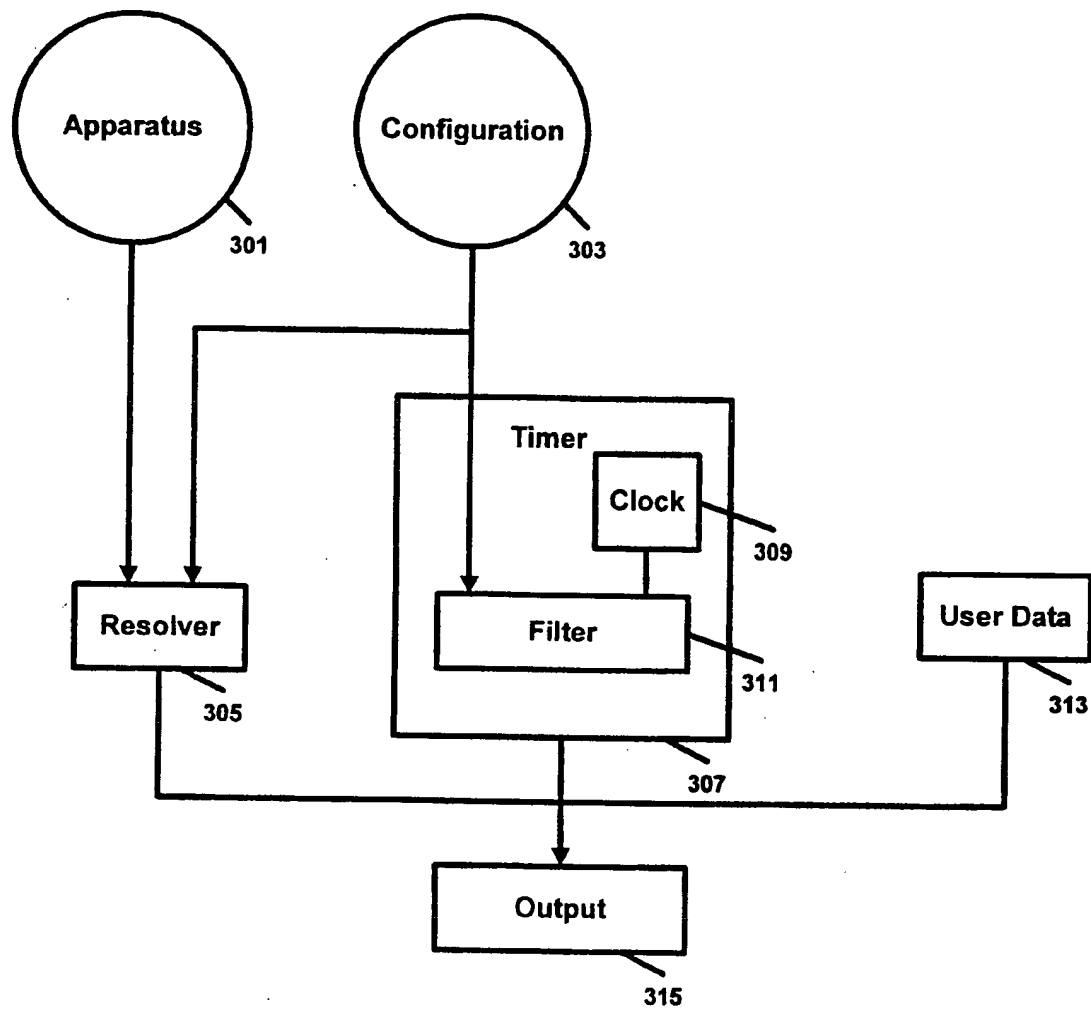


Figure 3

// Location identifying information

location → generation sequence time-stamp author device locationRes locationCus

// Physical attribute information

image → category size bit-or-push media set resolution stain format imageRes imageCus

// Parent identifying information

parent → time-stamp parentRes parentCus

Figure 4

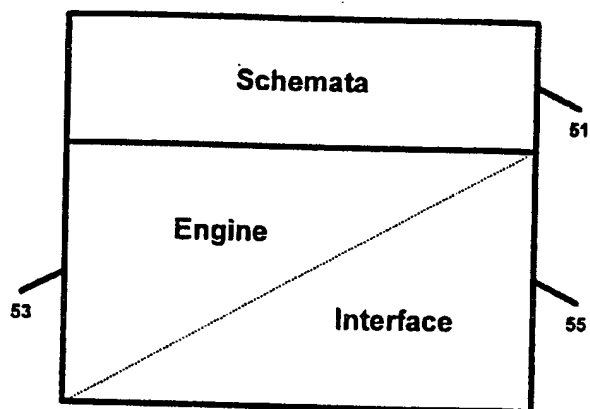


Figure 5

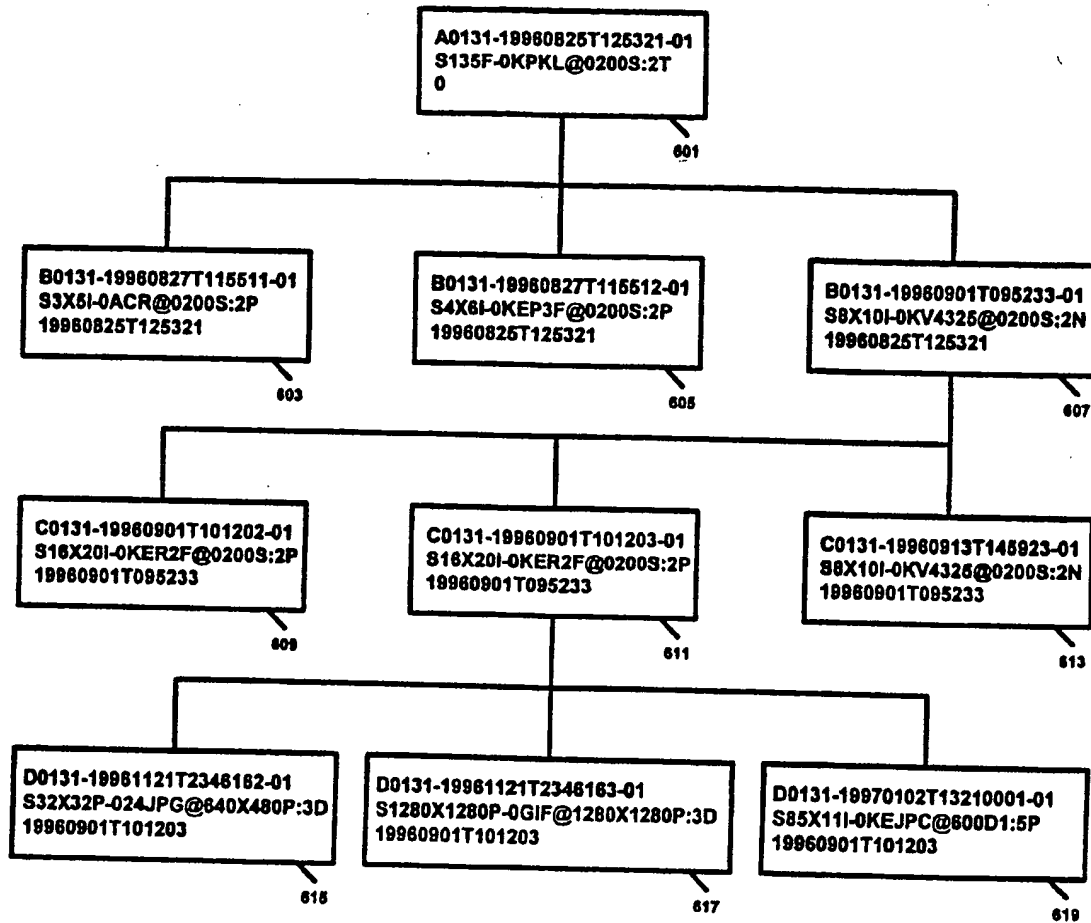


Figure 6

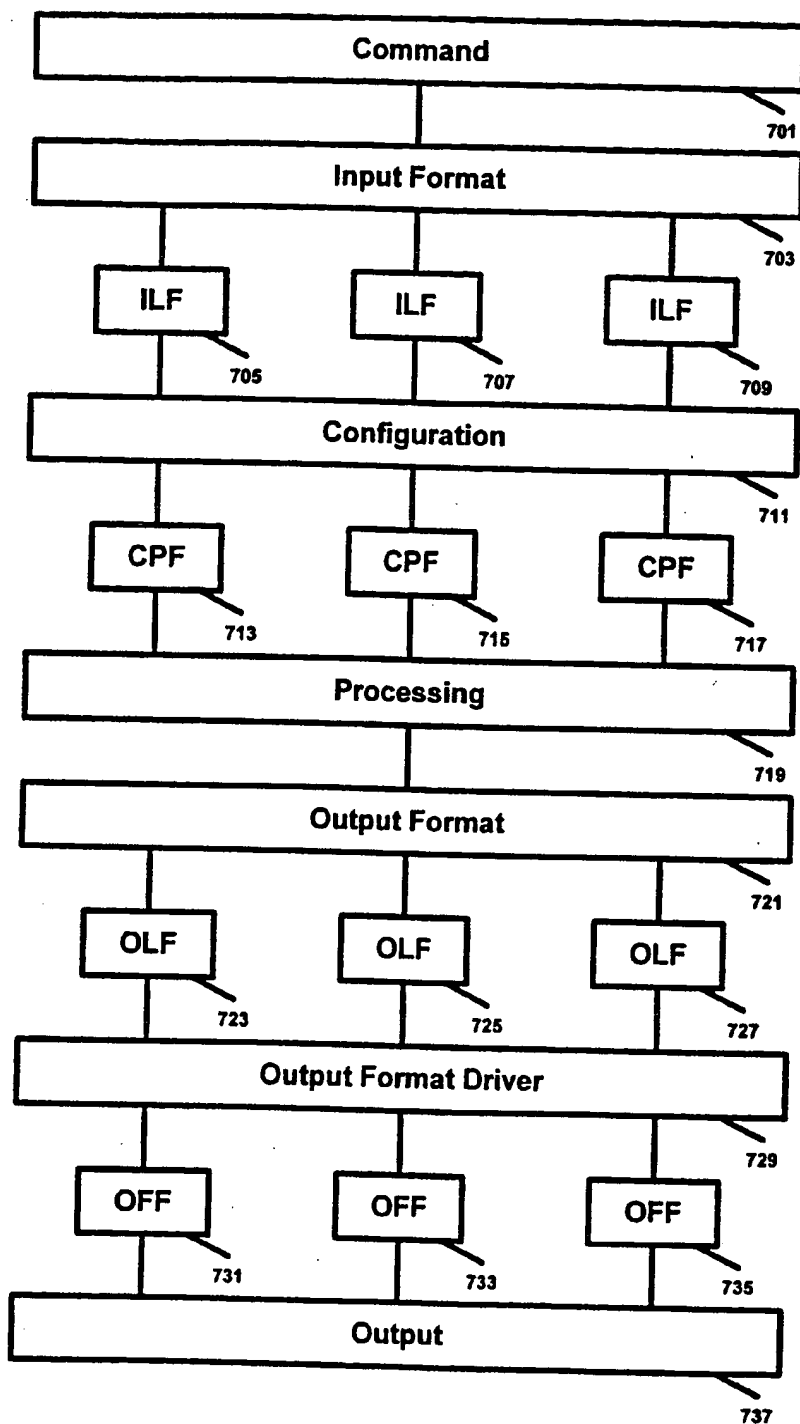


Figure 7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/00624

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N1/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 568 161 A (XEROX CORP) 3 November 1993	1,33
A	see the whole document	1,16,23,53
Y	US 5 008 700 A (OKAMOTO TSUGIO) 16 April 1991	1,33
A	cited in the application see abstract	47
A	US 5 193 185 A (LANTER DAVID) 9 March 1993 cited in the application see abstract	1,33
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

12 May 1998

Date of mailing of the international search report

25/05/1998

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/00624

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 86 05610 A (ALPHAREL INC) 25 September 1986 see abstract	1,23,33

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 98/00624

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